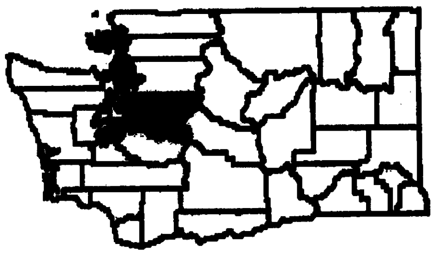
FLOOD INSURANCE STUDY

KING COUNTY, WASHINGTON
AND INCORPORATED AREAS
VOLUME 1 OF 3



Community Name	Community Number
*ALGONA, CITY OF	530072
AUBURN, CITY OF	530073
*BEAUX ARTS VILLAGE, TOWN OF	530242
BELLEVUE, CITY OF	530074
BLACK DIAMOND, TOWN OF	530272
BOTHELL, CITY OF	530075
BURIEN, CITY OF	530321
CARNATION, CITY OF	530076
*CLYDE HILL, TOWN OF	530279
DES MOINES, CITY OF	530077
DUVAL, TOWN OF	530282
ENUMCLAW, CITY OF	530319
FEDERAL WAY, CITY OF	530322
*HUNTS POINT, TOWN OF	530288
ISSAQUAH, CITY OF	530079
KENT, CITY OF	530080
KIRKLAND, CITY OF	530081
LAKE FOREST PARK, CITY OF	530082
*MEDINA, CITY OF	530315
*MERCER ISLAND, CITY OF	530083
NORMANDY PARK, CITY OF	530084
NORTH BEND, CITY OF	530085
PACIFIC, CITY OF	530086
REDMOND, CITY OF	530087
RENTON, CITY OF	530088
SEATAC, CITY OF	590320
SEATTLE, CITY OF	530089
SKYKOMISH, TOWN OF	530236
SNOQUALMIE, CITY OF	530090
TUKWILA, CITY OF	530091
WOODINVILLE, CITY OF	530324
*YARROW POINT, TOWN OF	530309
KING COUNTY, UNINCORPORATED AREAS	530071

*NON-FLOODPRONE COMMUNITIES

REVISED: APRIL 19, 2005

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
53033CV001A

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 may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Selected Flood Insurance Rate Map panels for the community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone	New Zone
A1 through A30	AE
V1 through V30	VE
B	X
C	X

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 10.0.

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

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FLOOD INSURANCE STUDY
KING COUNTY WASHINGTON AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the geographic area of King County, Washington, including the Cities of Auburn, Bellevue, Black Diamond, Carnation, Des Moines, Duvall, Enumclaw, Issaquah, Kent, Kirkland, Lake Forest Park, Normandy Park, North Bend, Pacific, Redmond, Renton, Seattle, Snoqualmie, Algona, Burien, Federal Way, Hunts Point, Medina, Mercer Island, Woodinville, Yarrow Point, Bothell, SeaTac, and Tukwila, the Towns of Skykomish, Clyde Hill, and Beaux Arts Village, and the unincorporated areas of King County (hereinafter referred to collectively as King 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.

This Flood Insurance Study investigates and/or revises and updates previous Flood Insurance Studies/Flood Insurance Rate Maps for the cities of Auburn, Bellevue, Black Diamond, Carnation, Des Moines, Duvall, Issaquah, Kent, Kirkland, Lake Forest Park, Normandy Park, North Bend, Pacific, Redmond, Renton, Seattle, Snoqualmie, and Tukwila, the Town of Skykomish, and the unincorporated areas of King County. This information will be used by King County and the incorporated communities to update existing floodplain regulations as part of the Regular Phase of the NFIP. The information will also be used by local and regional planners to further promote sound land use and floodplain development.

The City of Bothell and the Town of Milton are bi-county communities. The technical information presented in this Flood Insurance Study for the incorporated portions of these communities is for information only. These communities each have individual effective Flood Insurance Studies.

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 Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for the original King County study were performed by the U.S. Army Corps of Engineers (COE), Seattle District, for the Federal Emergency Managemenet Agency (FEMA), under Inter-Agency Agreement No. IAA-H-2-73, Project Order No. 14, and Inter-Agency Agreement No. IAA-H-19-74, Project Order Nos. 1 and 15. This study was completed in August 1976. The Enplan Corporation, Consulting Engineers, Kirkland, Washington, assisted in the transfer of map data from photomosaic and topographic maps to the report work maps for the Seattle District, COE.

The hydrologic and hydraulic analyses for the Tolt River were performed by the U.S. Soil Conservation Service (SCS) for Flood Hazard Analyses, Tolt River, King County, Washington.

Hydrologic and hydraulic analyses for the communities of King County were performed by study contractors and are summarized below.

Community	Contractor	Contract Number	Completion Date
King County (revised study)	CH2M Hill Northwest, Inc., for FEMA	EMW-85-C-1893	June 1987
City of Seattle (revised study)	CH2M Hill Northwest, Inc., for FEMA	EMW-85-C-1893	June 1987
Portion of Upper Green River Valley upstream from Auburn	COE, Seattle District, for FEMA	Inter-Agency Agreement No. IAA-EMW-E-1153 Project Order No. 1	February 1988
City of Auburn (original study)	Tudor Engineering Co., for FEMA	H-4025, Amendment 4	May 1978
City of Auburn (revised study)	CH2M Hill Northwest, Inc., for FEMA	EMW-85-C-1893	June 1987
City of Bellevue	USGS, Water Resources Division for FEMA	Inter-Agency Agreement No. IAA-H-8-76, Project Order No.3	May 1977

Community	Contractor	Contract Number	Completion Date
City of Carnation	CH2M Hill, Inc., for FEMA	H-4600	August 1978
City of Des Moines	CH2M Hill, Inc., for FEMA	H-4600	September 1978
City of Duvall	CH2M Hill, Inc., for FEMA	H-4600	September 1978
City of Issaquah	Tudor Engineering Co. for FEMA	H-4025	September 1977
City of Kent (original study)	Tudor Engineering Co., for FEMA	H-4025 Amendment No. 13	June 1979
City of Kent (revised study)	CH2M Hill Northwest, Inc., for FEMA	EMW-85-C-1893	June 1987
City of Kirkland	Tudor Engineering Co., for FEMA	H-4025	December 1977
City of Lake Forest Park	CH2M Hill, Inc., for FEMA	H-4600	August 1978
City of Normandy Park	CH2M Hill, Inc., for FEMA	H-3815	June 1976
City of North Bend	CH2M Hill, Inc., for FEMA	H-4600	October 1981
City of Pacific	CH2M Hill, Inc., for FEMA	H-4600	April 1979
City of Redmond	Tudor Engineering Co., for FEMA	N/A	August 1977
City of Redmond (additional hydrologic & hydraulic analyses)	COE, Seattle District for FEMA	N/A	August 1976
City of Renton (original study)	Tudor Engineering Co. for FEMA	H-4025	July 1979
City of Renton (revised study)	CH2M Hill, Northwest, Inc., for FEMA	EMW-85-C-1893	June 1987

Community	Contractor	Contract Number	Completion Date
Town of Skykomish	CH2M Hill, Inc. for FEMA	H-4600	July 1979
Town of Snoqualmie	CH2M Hill, Inc. for FEMA (additional data from COE)	H-4810	July 1981
City of Tukwila	Tudor Engineering Co., for FEMA	H-4025, Amendment No. 10	April 1979

1.3 Coordination

The coordination for the original King County Flood Insurance Study was completed in multi-agency conferences managed by the FEMA Consultation and Coordination Officer (CCO). The State of Washington Department of Ecology provided input to establish the study priority and the contracting agency. The King County Division of Hydraulics offered valuable assistance to the COE and the study contractor, in establishing the scope of this study, coordinating basic data and defining approximate floodplain boundaries. Topographic maps at contour intervals of 5 feet, which served as part of the input for the hydraulic analysis and the location of the floodplain boundary lines, were supplied by the King County Department of Public Works. The county also provided information on certain elevation reference marks.

Contacts with the private engineering firms of Bush Roed and Hitchings, Inc., of Seattle, and Horton Dennis and Associates, Inc., of Seattle, were made during the study to discuss field surveys they had conducted.

Permission to enter restricted areas for field surveys was obtained from the City of Seattle and the Chicago, Milwaukee, St. Paul and Pacific Railroad.

The final CCO meeting was held at the offices of the King County Public Works Department on June 25, 1976. King County officials objected to the "equal conveyance" floodways that were developed in accordance with FEMA guidelines, wanting to apply more stringent floodway criteria. They were especially concerned about the Snoqualmie River, fearing that the loss of valley storage would increase peak discharges if the fringe were filled.

The initial coordination meeting for the original City of Auburn study was held on April 8, 1976. At this meeting, streams to be studied by detailed methods were identified by representatives of the community, the study contractor, and FEMA. During the course of the work, numerous informal contacts were made by the study contractor with the community for the purpose of obtaining data and base maps.

On March 17, 1978, the results of the work were reviewed at an intermediate coordination meeting attended by representatives of the city, the study contractor, and FEMA.

The results of this study were reviewed at a final community coordination meeting held on December 6, 1978. Attending the meeting were representatives of FEMA, the study contractor, and the city. This study incorporates all appropriate comments, and all problems have been resolved.

The initial coordination meeting for the City of Bellevue study was held in April 1975. This meeting was attended by personnel of the U.S. Geological Survey (USGS), FEMA, and officials of the Bellevue Planning and Storm Drainage Utility Departments. Community base maps were selected and streams requiring detailed study were identified.

A search for basic data was made at all levels of government. Topographic maps with a 5-foot contour interval were supplied by the Bellevue city engineer; these served as preliminary work maps on determining the location of floodplain boundary lines. Some locations and elevations of bench marks were provided by the City and verified by USGS levels.

During the course of the work by the USGS, flood elevations, floodplain boundaries, and floodway delineations were reviewed with community officials. On April 29, 1977, the results of the work by the USGS were reviewed at a final CCO meeting attended by personnel of the USGS, FEMA, and officials of the Bellevue Planning and Storm Drainage Utility Departments.

The initial coordination meeting for the City of Carnation was held in the Carnation Town Hall on July 29, 1977, At the meeting, flooding sources for the City of Carnation were defined and the areas to be studied were identified. Representatives from the City of Carnation, CH2M HILL, Inc. (the study contractor), and FEMA attended the meeting.

Throughout the study, coordination was maintained with the COE, King County hydraulics division, town officials, Sammamish Valley newspaper, Carnation Planning Commission, and King County Planning Commission. All were contacted to provide information pertinent to this Flood Insurance Study.

The results of this study were reviewed at a final community coordination meeting held on December 19, 1978. Attending the meeting were representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting.

The initial coordination meeting for the City of Des Moines was held on August 19, 1977. This meeting was attended by representatives of the study contractor, FEMA, and the city. This meeting was held to identify areas requiring detailed study and to familiarize city officials with all aspects of the study and to solicit pertinent information.

The Des Moines city government; the Covenant Beach Bible Camp management; and King County Department of Public Works, Division of Hydraulics, were contracted for the coordination of this Flood Insurance Study.

The results of this study were reviewed at a final community coordination meeting held on March 26, 1979. Attending the meeting were representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting.

In 1981, the City of Des Moines annexed an area along Puget Sound south of the Des Moines Marina. A detailed wave runup analysis of this area was completed in May 1984. An area west of Pacific Highway South (State Highway 99) between Kent-Des Moines Road and South 252nd Street has also been annexed by the City. The analysis to determine the extent of approximate floodplain boundaries in this area was completed in January 1985 and used to update this study.

The initial coordination meeting for the City of Duvall was held in the Duvall City Hall on July 28, 1977. At the meeting, flooding sources for the City of Duvall were defined and the areas to be studied were identified. Representatives from the City of Duvall, the study contractor, and FEMA attended the meeting.

The King County Department of Public Works, Division of Hydraulics; the Sammamish Valley News; and the Duvall Planning Commission were contracted for information pertinent to this Flood Insurance Study.

The results of this study were reviewed at a final community coordination meeting held on October 2, 1978. Attending the meeting were representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting.

The initial coordination meeting for the City of Issaquah was held on April 8, 1976. The identification of streams selected for detailed analysis was accomplished at this meeting which was attended by representatives of the community, the State of Washington Department of Ecology, FEMA, and a study contractor who was initially chosen to perform the study but did not finally participate.

During the course of the work numerous informal contacts were made by Tudor Engineering Company personnel with the community for the purpose of obtaining information and confirming data. Previous work by the COE was reviewed and forms the basis of this study.

On January 27, 1977, the results of the work were reviewed at an intermediate coordination meeting attended by representatives of the City of Issaquah, Tudor Engineering Company, and FEMA. A final coordination meeting held on April 2, 1979, resulted in agreement by the same parties, and this report incorporates resolution of all comments received as a result of coordination activities.

The initial coordination meeting for the original City of Kent study was held on April 8, 1976. Streams to be studied by detailed methods were identified at this meeting, which was attended by representatives of the City of Kent and FEMA.

During the course of work, the study contractor maintained contact with the COE; the King County Division of Hydraulics; and the City of Kent, Department of Public Works.

On May 29, 1979, the results of the study were reviewed at an intermediate coordination meeting attended by representatives of the City of Kent, the study contractor, and FEMA.

The results of this study were reviewed at a final community coordination meeting held on April 28, 1980. Attending the meeting were representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting.

On April 8, 1976, the initial coordination meeting for the City of Kirkland was held to determine streams to be studied by detailed analysis. This meeting was attended by representatives of the city, FEMA, and the study contractor who was originally chosen to perform the work but did who not finally participate.

During the course of the work, numerous informal contacts were made by the study contractor with the community for the purpose of obtaining data and base maps.

On November 30, 1977, the results of the work were reviewed at an intermediate coordination meeting attended by representatives of the City of Kirkland, the study contractor, and FEMA.

The results of this study were reviewed at a final community coordination meeting held on May 12, 1980. Attending the meeting were representatives of FEMA, the study contractor, and the City. This study incorporates all appropriate comments, and all problems have been resolved.

In August 1977, the initial coordination meeting for the City of Lake Forest Park was held. Streams requiring detailed and approximate study were identified at this meeting attended by representatives of the study contractor, FEMA, and the City of Lake Forest Park.

Initial contact with the Lake Forest Park City Manager, who is also the Public Works Director, was made in February 1978. The City Manager provided background data in the community and descriptions of flood hazard areas in Lake Forest Park. The King County Public

Works Department and the USGS were contacted to provide information pertinent to this Flood Insurance Study for Lake Forest Park.

The results of this study were reviewed at a final community coordination meeting held on December 12, 1978. Attending the meeting were representatives of FEMA and the study contractor, as well as city officials and interested citizens. No problems were raised at the meeting.

The initial coordination meeting for the City of Normandy Park was held on December 5, 1975. It was attended by representatives of the study contractor, FEMA, and officials of Normandy Park. This meeting was held to identify streams requiring detailed study, to familiarize city officials with all aspects of the study, and to solicit pertinent information.

A search for basic data was made at all levels of government. The City of Normandy Park, the King County Zoning and Plans Division, the King County Hydraulics Commission and CH2M HILL, Inc. provided maps and other data used in this study.

On August 6, 1976, the results of the work effort by CH2M HILL Inc., were reviewed at the final CCO meeting attended by personnel of the study contractor, FEMA, and officials of the City of Normandy Park. The comments of the officials were incorporated and the study accepted.

The initial coordination meeting for the City of North Bend was held on July 29, 1977. Streams requiring detailed study were identified at this meeting attended by representatives of the study contractor, FEMA, the State of Washington Department of Ecology, King County, and the City of North Bend.

In March 1981, an approximate study was added to the scope of study as a result of consultation among representatives of FEMA, the City of North Bend, and the study contractor.

The King County Engineering and Public Works Departments were contacted to discuss past flooding problems and to gather available topographic mapping and levee plans along with aerial photographs of recent flooding events. The COE was also contacted to obtain recently developed hydrologic and hydraulic information pertinent to this Flood Insurance Study. The hydrology presented in this study was coordinated with COE, the State of Washington Department of Ecology, and the King County Department of Public Works.

On September 22, 1981, the results of the study were reviewed at an intermediate coordination meeting attended by representative of the city, the State of Washington Department of Ecology, FEMA, and the study contractor. No problems were raised at the meeting.

The final coordination meeting was held on September 13, 1982, and was attended by representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting.

The initial coordination meeting for the City of Pacific was held on August 1, 1977. Rivers and drainage ditches requiring detailed and approximate study were identified at this meeting attended by representatives of FEMA, the city, and the study contractor.

The COE, the USGS, the Washington State Department of Highways, Tudor Engineering, city officials, and local citizens provided information used in the report.

The results of the study were reviewed at a final community coordination meeting held on December 3, 1979. Attending the meeting were representatives of FEMA, the study contractor, and the Pacific City Council and members of the public. As a result of this meeting, an area of moderate flood hazard was added to the map.

An initial coordination meeting for the City of Redmond was held to identify streams requiring detailed study. This meeting was attended by representatives of the City of Redmond, FEMA, and the study contractor. Results of the hydrologic analyses were coordinated with the City of Redmond, FEMA, and Tudor Engineering Company.

During the course of the work, numerous informal contacts were made by Tudor Engineering Company, which conducted the study, with community officials for the purpose of obtaining information and confirming data. Previous work by the COE was reviewed and forms the basis of this study.

The results of the study were reviewed at the final meeting attended by representatives of the study contractor, FEMA, and community officials. The study was acceptable to the community.

The initial coordination meeting for the original City of Renton study was held on April 8, 1976. Streams selected for detailed analysis were identified at this meeting attended by representatives of the community, the original study contractor, and FEMA.

On July 13, 1979, the results of the work were reviewed at an intermediate coordination meeting attended by representatives of the City, the study contractor, and FEMA.

The results of this study were reviewed at a final community coordination meeting held on May 5, 1980. Attending the meeting were representatives of FEMA, the study contractor, and the city. No problems were raised at meeting.

The initial coordination meeting for the Town of Skykomish was held on July 29, 1977. Streams requiring detailed and approximate study were identified at this meeting attended by representatives of the study contractor, FEMA, and the Town of Skykomish. Town officials provided background data on the community and descriptions of known flood hazard areas in Skykomish.

The King County Public Works Department, the COE, and the USGS were contacted for additional information to this Flood Insurance Study.

The results of this study were reviewed at a final community coordination meeting held on April 21, 1980. Attending the meeting were representatives of FEMA, the study contractor, and the town. This study incorporates all appropriate comments, and all problems have been resolved.

The initial coordination meeting for the City of Snoqualmie was held on May 31, 1978. Streams requiring detailed study were identified at this meeting attended by representatives of the study contractor, FEMA, the COE, and the City of Snoqualmie. A series of meetings was also attended by the city officials, FEMA, and study contractor representatives to discuss possible floodway alternatives. These meetings were held in March 1979, January 1981, and June 1981, and initially resulted in the selection of an equal conveyance floodway for the study. The requirement for expansion of the study to include additional detailed and approximate study mapping for and expected annexation to the city was discussed at the intermediate community coordination meeting held November 4, 1981, and attended by representatives of the study contractor, FEMA, and the City of Snoqualmie.

At the final community coordination meeting held on August 1, 1983, city officials requested that an alternative negotiated floodway be considered that would more fully meet the City's needs along with those of the adjacent county jurisdiction and ownerships. A negotiated floodway was developed for and approved by the City, King County, and affected county ownerships by written correspondence received during the period from October 1983 to January 1984.

Results of the hydrologic analyses were coordinated with the COE, the State of Washington Department of Ecology, and the King County Department of Public Works.

The initial coordination meeting for the City of Tukwila was held on April 8, 1976. Streams selected for detailed analysis were identified at this meeting attended by representatives of the community and FEMA.

During the course of the work, numerous informal contacts were made by the study contractor with the community in order to obtain data and base maps. Data were also obtained from the COE.

On March 26, 1979, the results of the work were reviewed at an intermediate coordination meeting attended by representatives of the City, the study contractor, and FEMA.

The results of this study were reviewed at a final community coordination meeting held on December 10, 1979. Attending the meeting were representatives of FEMA, the study contractor, and the city. No problems were raised at the meeting.

Initial community coordination meetings for the revised study for King County, Washington, and the Cities of Auburn, Kent, Renton, and Seattle, all within King County, were held on January 16, 1985, and January 24, 1985. At the January 16, 1985, meeting, representatives of FEMA, King County, the Cities of Auburn, Kent and Renton, the Washington Department of Ecology, and the study contractor, CH2M HILL, Inc., identified streams requiring detailed and approximate study. Representatives of FEMA, the City of Seattle, and CH2M HILL, Inc., identified streams requiring detailed and approximate study at a meeting held on January 24, 1985. The purposes of the meetings were: (1) to inform the county on its status in the NFIP; (2) to identify existing flooding problems and available pertinent data on flooding in the county and cities, and (3) to reach an agreement on the areas to be studied.

During the course of the study, numerous contacts were made and meetings held with local agencies and community officials to discuss and gather available data on flooding history, methods and preliminary results of analyses, and status of proposed near-term drainage system improvements for those flooding sources under study. The USGS was contacted and requested to provide available flow data and data analyses for the streams being studied and surrounding regional drainages. The COE and the SCS were also contacted and asked to provide any data or studies they had that were relevant to flooding caused by the streams under study.

Correspondence with the Washington State Department of Transportation (WSDOT) pertained to proposed plans and timing of drainage structure improvements for Rolling Hills Creek and Springbrook Creek under Interstate Highway 405 (City of Renton). Information was also requested for drainage improvements to State Route 522 and NE 195th Street, at their crossings of Little Bear Creek.

The initial meeting was held with King County personnel to request available hydrologic and hydraulic information and accounts of flooding history for the flooding sources under study on December 5, 1985. King County Surface Water Management Division staff were contacted and asked to provide basin planning studies and information on any near-term planned drainage system improvements for the flooding sources under study. Design drawings for two bridges being constructed as part of Soos Creek Park on Big Soos Creek were made available through contacts with the King County Division of Parks and Recreation. The Surface Water Division's maintenance personnel were asked to provide information on the operation of the P1 pumping station on the Black River, and on the flooding history of the streams being studied.

Storage floodway concepts for local drainages in the Green River Valley, including Mill Creek (Auburn), were discussed at meetings attended by representatives of King County, the Cities of Auburn and Kent, FEMA, and the study contractor, CH2M HILL, Inc.

Preliminary results of analyses for the Green River and levee freeboard issues were presented and discussed at a public meeting on September 11, 1986, attended by representatives from King County, the City of Auburn, the City of Kent, FEMA, and CH2M HILL, Inc.

City of Kent personnel were asked to provide data for a recent drainage basin study prepared for Mill Creek (Kent). Information on proposed drainage improvements for flooding sources under study in the Cities of Auburn, Kent, Renton, and Seattle were requested in the initial stages of study.

Results of the hydrologic analyses were coordinated with community officials, the COE, the SCS, and the USGS.

In March 1987, a coordination meeting for representatives of the COE, Seattle District, and FEMA was held. An analysis of an upper reach of the Green River, immediately above the reach studied in the 1987 King County restudy, was identified. This study was performed under FEMA's Limited Map Maintenance Program.

The final community coordination meetings were held on December 6 and 7, 1988, and were attended by representatives of FEMA, the COE, and the county. The study was acceptable to the county.

2.0 AREA STUDIED

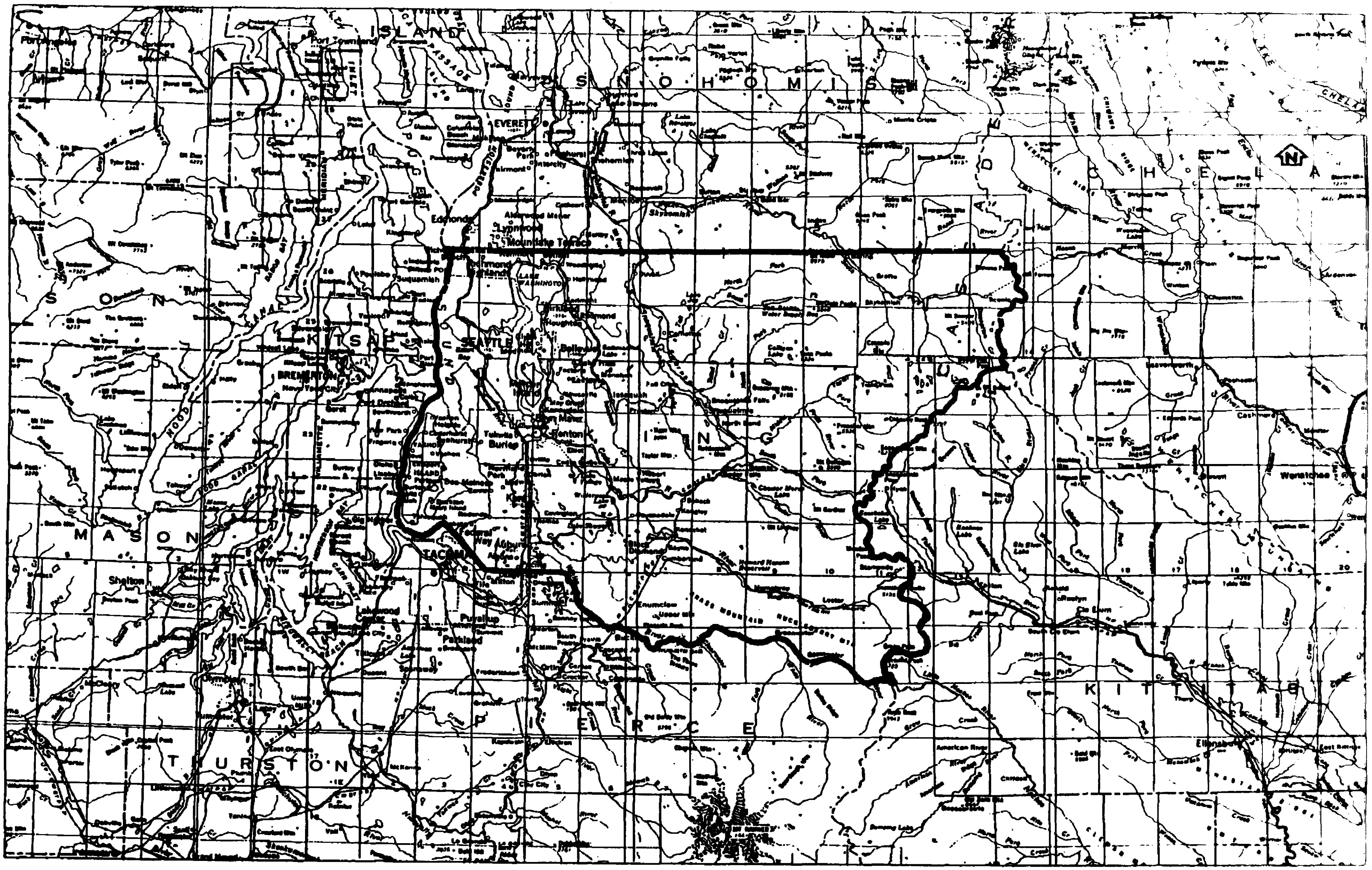
2.1 Scope of Study

This Flood Insurance Study covers the geographic area of King County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through 1992.

The following streams were studied by detailed methods in the revised study:

Raging River	-	From Interstate Highway 90 to 0.3 mile upstream of the second Upper Preston Road bridge
Green River	-	From approximately 0.3 mile downstream of Pacific Highway to confluence with Big Soos Creek



FIGURE

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

Black River/ Springbrook Creek	-	From confluence with Green River to SW 16th Street
Mill Creek (Auburn)	-	From confluence with Green River to Highway 18 bridges at RM 6.2
Mill Creek (Kent)	-	From Highway 167 to limit of previous detailed study at the Earthworks Park stormwater detention facility outlet
Big Soos Creek	-	From confluence with Covington Creek to SE 176th Street
Swamp Creek	-	From confluence with Sammamish River to northern King County boundary
Little Bear Creek	-	From confluence with Sammamish River to northern King County boundary
Bear/Evans Creek	-	From limit of previous detailed study at confluence with Cottage Creek to Paradise Lake
Issaquah/Holder Creek	-	From limit of previous detailed study at SE May Valley Road to Highway 18
West Fork Issaquah Creek	-	From confluence with Issaquah Creek to SE 128th Way
May Creek	-	From Coal Creek Parkway bridge to SE 109 Place
May Creek Tributary	-	From confluence with May Creek to 188th Avenue SE
Cedar River	-	From Lake Washington to approximately RM 2.1
North and South Forks of Thornoton Creek	-	From confluence with Lake Washington to Interstate Highway 5
Longfellow Creek	-	From SW Brandon Street to SW Thistle Street
Rolling Hills Creek	-	Between first and second crossings of Interstate Highway 405

The Upper Green River was studied by detailed methods in the COE February 1988 study from its confluence with Big Soos Creek to Flaming Geyser Bridge.

The Tolt River was studied by detailed methods in the SCS June 1982 study from approximately 6,300 feet upstream of the Chicago Milwaukee, St. Paul & Pacific Railroad to approximately 5.5 miles upstream of the Railroad, a reach of approximately 4.3 miles.

The following streams studied by detailed methods were taken directly from previous Flood Insurance Studies covering King County and incorporated areas (References 1 to 18).

Snoqualmie River	-	From the Snohomish County line to the confluence with Middle Fork Snoqualmie River, a reach of approximately 45 miles
Middle Fork Snoqualmie River	-	From a point approximately 2,323 feet downstream of SE 428th Avenue to a point approximately 2,323 feet upstream of Mount Si Road, a reach of approximately 3.37 miles
North Fork Snoqualmie River	-	From confluence with Snoqualmie River to a point approximately 5,914 feet upstream of 428th Avenue SE, a reach of approximately 1.5 miles
South Fork Snoqualmie River	-	From confluence with Snoqualmie River to a point approximately 8,000 feet downstream of 436th Avenue SE, a reach of approximately 3.8 miles. (Note: A portion of South Fork Snoqualmie River just upstream of the above-referenced detailed study reach is now depicted as approximate 100-year flooding. This change was made because updated analysis along that reach superceded the detailed analysis and elevations shown on the effective county map (Reference 1).
Green River	-	From its mouth to confluence with Black River and from Flaming Geyser Bridge to a point approximately 7,286 feet upstream of Whitney Road
Springbrook Creek	-	From SW 16th Street to a point approximately 1,690 feet upstream of South 228th Street, a reach of approximately 6.32 miles

Mill Creek (Auburn)	- From State Highway 18 to a point approximately 845 feet upstream of 15th Street SW, a reach of approximately 0.72 miles
Mill Creek (Kent)	- From its mouth to State Highway 167, a reach of approximately 4.24 miles
White River	- From a point approximately 4,330 feet downstream of Burlington Northern Railroad to the Muckleshoot Indian Reservation, a reach of approximately 3.38 miles
White River (Left Bank Overflow)	- From confluence with White River to the Muckleshoot Indian Reservation, a reach of approximately 0.70 mile
Sammamish River	- From its mouth at Lake Washington to the mouth of Lake Sammamish, a reach of approximately 15.3 miles
North Creek	- From its mouth to a point approximately 10 feet upstream of NE 205th Street at the corporate limits of Bothell, a reach of approximately 1.45 miles
Bear Creek	- From confluence with Sammamish River to confluence with Cottage Lake Creek, a reach of approximately 5.35 miles
Evans Creek	- From confluence with Bear Creek to a point approximately 2,059 feet upstream of 220th Avenue NE, a reach of approximately 4.66 miles
Issaquah Creek	- From its mouth at Lake Sammamish to Southeast May Valley Road, a reach of approximately 8.0 miles
North Fork Issaquah Creek	- From confluence with Issaquah Creek to a point approximately 740 feet upstream of Issaquah Avenue North, a reach of approximately 0.95 mile
East Fork Issaquah Creek	- From confluence with Issaquah Creek to a point approximately 1,711 feet upstream of 3rd Avenue NE, a reach of approximately 0.87 mile

Tibbetts Creek	-	From its mouth to a point approximately 4,610 feet upstream of State Highway 900, a reach of approximately 2.3 miles
May Creek	-	From Barbee Mill Road to a point approximately 2,535 feet upstream of NE 31st Street, a reach of approx-imately 2.02 miles
Vasa Creek	-	From the corporate limits of the City of Bellevue approximately 2,500 feet upstream from its mouth to a point approximately 225 feet upstream
Cedar River	-	From a point approximately 2,629 feet upstream of Interstate Highway 405 to a point approximately 7,920 feet upstream of the Chicago, Milwaukee, St. Paul and Pacific Railroad, a reach of approximately 19 miles
Mercer Creek	-	From its mouth to the confluence of Kelsey Creek and Richards Creek, a reach of approximately 12.9 miles
Mercer Creek Right Channel	-	Its entire length, a reach of approximately 1.0 mile
Richards Creek	-	From confluence with Mercer Creek to a point approximately 380 feet upstream of SE Allen Road, a reach of approximately 2.65 miles
Richards Creek West Tributary	-	From confluence with Richards Creek to a point approximately 310 feet upstream of SE 32nd Street, a reach of approximately 3.22 miles
Richards Creek East Tributary	-	From confluence with Richards Creek to a point approximately 680 feet upstream of SE 26th Street, a reach of approximately 0.24 miles
Kelsey Creek	-	From its mouth to a point approximately 760 feet upstream of SE 16th Street, a reach of approximately 5.08 miles

West Tributary Kelsey Creek	-	From confluence with Kelsey Creek to Redmond Bellevue Road, a reach of approximately 1.57 miles
East Branch of West Tributary Kelsey Creek	-	From confluence with West Tributary Kelsey Creek to a point approximately 842 feet upstream of 137th Avenue NE, a reach of approximately 0.44 miles
North Branch Mercer Creek (North Valley)	-	From confluence with Kelsey Creek to a point approximately 4,862 feet upstream of NE 24th Street, a reach of approximately 1.49 miles
McAleer Creek	-	From a point approximately 40 feet upstream of Bothell Way NE to a point approximately 3,340 feet upstream of NE 185th Street, a reach of approximately 2.13 miles
Coal Creek	-	From its mouth to the City of Bellevue corporate limits at Interstate Highway 405 and from the City of Bellevue corporate limits 8,250 feet upstream of Interstate Highway 405 to a point 9,690 feet upstream of Interstate Highway 405, a total length of approximately 0.95 miles
Forbes Creek	-	From the City of Kirkland corporate limits approximately 1,420 feet upstream from its mouth to a point approximately 496 feet upstream of NE 108th Street, a reach of approximately 5.66 miles
Lyon Creek	-	From confluence with Lake Washington to 35th Avenue NE and from a point approximately 80 feet downstream of Ballinger Road to a point approximately 760 feet upstream of Ballinger Road, a total distance of approximately 1.42 miles
Yarrow Creek	-	From 116th Avenue NE to a point approximately 1,515 feet upstream of NE 34th Street, a reach of approximately 0.36 mile

Meydenbauer Creek	-	From its mouth to a point approximately 520 feet upstream of 102nd Avenue SE, a reach of approximately 0.36 mile
North Fork Mendenbauer Creek	-	From confluence with Meydenbauer Creek to a point approximately 830 feet upstream
South Fork Skykomish River	-	From a point approximately 1,505 feet downstream of 5th Street to a point approximately 2,693 feet upstream of 5th Street, a reach of approximately 0.8 mile
Maloney Creek	-	From a point approximately 100 feet downstream of Burlington Northern Railroad to a point approximately 890 feet upstream of NE Old Cascade Highway, a reach of approximately 0.32 mile
Miller Creek	-	From its mouth to a point approximately 2,530 feet upstream of 12th Avenue SW, a reach of approximately 0.86 mile
Walker Creek	-	From confluence with Miller Creek to a point approximately 600 feet upstream of 12th Avenue SW, a reach of approximately 0.33 mile
Des Moines Creek	-	From its mouth at Puget Sound to a point approximately 1,960 feet upstream
Unnamed Drainageway	-	The ponding of an unnamed drainageway in the central business district in the City of Kirkland, between Central Way and Kirkland Way

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 community.

2.2 Community Description

King County, located in western Washington, is the largest center of population and economic growth in the State of Washington. Its eastern boundary is along the divide of the rugged Cascade Range, and is bordered on the west by Puget Sound. Contiguous counties related economically, as well as geographically, to King County are Kitsap County to the west, Chelan and Kititas Counties to the east, Snohomish County to the north, and Pierce County to the south.

Seattle is the county seat and largest city in Washington. It is located between Puget Sound and Lake Washington. Seattle is important as a port for foreign trade with Asian and South American countries as well as for domestic shipping with Alaska. The 1986 estimated population of Seattle was 488,200 (Reference 19). The area within the Seattle corporate limits is currently 91.6 square miles.

Auburn is located south of Kent. It is approximately 5 miles from the shores of Puget Sound and 24 miles south of Seattle. Auburn is bordered by Pierce County to the south and by the Cities of Algona and Pacific to the southwest. Auburn has a community area of approximately 20 square miles, and had a population of 29,950 in 1986 (Reference 19).

The City of Bellevue is located in northwest-central King County, 8 miles east of Seattle. Bellevue, Washington's fourth largest city, had a population of 73,903 in 1980 (Reference 20).

The City of Black Diamond is located in south-central King County. The city had a population of 1,170 in 1980 (Reference 20).

The City of Carnation, incorporated in 1912, is located in north-central King County, on the east bank of the Snoqualmie River. It is approximately 20 miles east of Seattle. Carnation had a population of 913 in 1980 (Reference 20).

The City of Des Moines, incorporated in 1959, is located in west-central King County. It is just south of the City of Normandy Park and southwest of the Seattle-Tacoma Airport. It is situated in one of the few areas in southern King County along Puget Sound where the land slopes gently down toward the water. According to City of Des Moines personnel, the 1988 population was 14,120.

The City of Duvall, incorporated in 1913, is located on State Highway 203, on the east bank of the Snoqualmie River, in northwestern King County. It is approximately 3.0 miles from the Snohomish County line and 7.0 miles north of Carnation. The city had a population of 729 in 1980 (Reference 20).

The City of Enumclaw is located in south-central King County, near the Pierce County line. Enumclaw had a population of 5,427 in 1980 (Reference 20).

The City of Issaquah is located in west-central King County, approximately 14 miles east of downtown Seattle. The city had a population of 5,536 in 1980 (Reference 20).

The City of Kent is located south of Renton and is within 2 to 5 miles of the shores of Puget Sound. The City of Tukwila is northwest of Kent and the City of Des Moines is to the west. Kent had a population of 28,620 in 1986 (Reference 19) and occupies an area of approximately 17 square miles. Most of Kent lies on the 2-mile-wide low-lying valley east of the Green River. The bluff area along the east boundary of Kent is drained by several creeks, including Mill, Springbrook, and Garrison Creeks.

The City of Kirkland is located approximately 5.0 miles northeast of downtown Seattle, in northwestern King County. Kirkland had a population of 18,779 in 1980 (Reference 20).

The City of Lake Forest Park is located in the Puget Sound region of northwest Washington in northwestern King County. The community is part of the suburban area that surrounds the Seattle metropolitan center. Lake Forest Park had a population of 3,372 in 1990.

The City of Normandy Park is located on Puget Sound in southwestern King County. It is located west of the Seattle-Tacoma Airport and due south of Burien Lake. Normandy Park had a population of 4,268 in 1980 (Reference 20).

The City of North Bend is located in central King County. It lies in the foothills of the Cascade Mountains, approximately 25 miles east of Seattle along Interstate Highway 90. The City of North Bend had a population of 1,701 in 1980 (Reference 20).

The City of Pacific is located in southwestern King County. It shares common boundaries with the City of Algona to the north and Pierce County to the south. The City of Pacific had a population of 2,261 in 1980 (Reference 20).

The City of Redmond lies in northwest-central King County. It is approximately 10 miles northeast of downtown Seattle. Redmond had a population of 23,318 in 1980 (Reference 20).

The City of Renton is located in western King County. It is located approximately 11 miles southeast of Seattle just north of Kent and just east of Tukwila. Renton had a population of 34,460 in 1986 (Reference 19).

The Town of Skykomish is located in northwestern King County. It is in a narrow valley along the south side of the South Fork Skykomish River and is surrounded by the Snoqualmie National Forest. Skykomish had a population of 209 in 1980 (Reference 20).

The City of Snoqualmie is located in central King County. The city lies near the foothills of the Cascade Mountains, approximately 25 miles east of Seattle along Interstate Highway 90. Snoqualmie had a population of 1,370 in 1980 (Reference 20).

The City of Tukwila is located in west-central King County. It is northwest of Kent and west of Renton. It is approximately 12 miles south of Seattle and 22 miles northwest of Tacoma. Tukwila had a population of 3,578 in 1980 (Reference 20).

The population of King County was 1,361,700 as of April 1986, with 561,183 residing in the unincorporated areas, mostly surrounding the large population center of Seattle. In most suburban communities and unincorporated areas of west-central King County, a decline in farming and significant transition to residential and industrial/commercial development has occurred. Urbanization has spread up the Green and Cedar River valleys where urban build up now covers more than one fourth of the basin's land areas. The Sammamish River valley is another site for increased residential and industrial/commercial uses. The Snoqualmie River valley is presently the county's primary district for farming and the dairy industry, but urbanization pressures exist for conversion of those agricultural lands to higher value, more intensive land use.

The climate of King County is predominately a mid-latitude, west coast, marine type. Most of the air masses that reach the Puget Sound area originate over the Pacific Ocean. In late fall and winter these masses are moist and about the same temperature as the ocean surface. Orographic effects caused by lifting and cooling of air masses moving inland result in a wide range of precipitation patterns over King County. Fifty percent of the annual precipitation typically occurs in the 4-month period of October through January, and 75 percent occurs in the 6 months from October through March. Below 1,500 feet in elevation, the winter precipitation normally falls as rain, occasionally interrupted by periods of snow. During the warmest summer months, the average afternoon temperatures over the county's Puget Sound lowlands are in the lower 70s, decreasing into the 60s in the mountains. Temperatures reach 85°F to 90°F about 5 to 15 days per year, and extremes up to 100°F have occurred in the lower valleys. In winter, afternoon temperatures over the lowlands typically range from 35°F to 45°F. The Japanese Current generally moderates the temperatures of winter, but almost every winter there are a few nights when the temperatures range from 10°F to 20°F, with extremes to 0°F.

All of the watersheds in King County are free from glaciers, unlike many streams in other counties lying between the Cascades and Puget Sound.

The undisturbed land cover in King County is dominated by dense conifer forests, with some grass covered prairie-like areas in the lowlands. However, those lowland areas are interspersed with scattered stands of Douglas fir and Oregon white oak. Scotchbroom, and other shrubs and seasonal groundcover are typical of those areas. Fresh water marshes commonly have cover consisting of cattails, rushes, and sedges. Big leaf maple trees and red alder are very common between the foothills and Puget Sound.

2.3 Principal Flood Problems

Climatic and topographic conditions of the upper Snoqualmie Valley create two distinct high-flow periods each year. In the spring or early summer, the seasonal rise in temperature melts snow in the headwaters and causes increased flow. The other high-flow period, the winter flood, is the most damaging. Winter storms bring in moisture-laden air from the Pacific Ocean and mild temperatures causing snowmelt, combined to cause floods of high magnitude and short duration. Most of the major floods have occurred during November, December, January, and February.

Without the protection by flood control reservoirs, the communities along the free flowing Snoqualmie River and its forks are vulnerable to severe flooding such as occurred in November 1959 and December 1975. The largest known flood in the Snoqualmie-North Bend area occurred on November 23, 1959. As the rivers in the basin swelled on that November day, there occurred a classic example of how wildly a river can change its course. About 9 miles east of the City of North Bend, the South Fork cut a new channel on the opposite side of its valley through what was a section of the main cross state arterial, the Snoqualmie Pass Highway. Atop its newly cut southerly bank, described as a steep clay cliff, remained the former river bed. The torrent on the South Fork left countless homes damaged in North Bend and contiguous areas.

The violent turbulence of the Middle Fork washed out principal bridges and left other spans badly damaged. This misfortune left over 50 families stranded for over a week. Some residents on necessary business, some school children, and carriers of mail and milk treaded lightly by foot across the listing bridges that continued to slip on their supports after the flood.

In the City of Snoqualmie, muddy water swept through many homes leaving a trail of destruction. A portion of a city street sank, developing a large cavity as water collected without a natural outlet. Truckloads of concrete slabs and 58 loads of gravel were dumped into the cavity during the flood to save the road, and to prevent adjacent buildings from being swept away. For the entire night of the flood there was no electrical power in the City of Snoqualmie. This flood had a discharge at the USGS gage near the City of Snoqualmie of 61,000 cubic feet per second (cfs). This discharge is equivalent to a 25-year flood at this point (Reference 21).

The largest known flood in the Carnation area occurred in December 1975. Agriculture and transportation damages constituted the principal losses. However, the lower valley is inundated to some extent almost every winter. Other major floods occurred in February 1932, December 1967, and January 1969.

Storms which cause flooding in the Tolt River Watershed are usually asociated with long, steady rains (i.e., winter maritime occluded frontal systems) which are typified by longer duration, more uniform intensity, and more evenly distributed precipitation than the unstable shower (convective) storms. With this type of rainstorm, the flooding in one basin, such as the Tolt, will be associated with flooding on adjacent basins; thus, the rare occurrence of a 100-year frequency flood on the Tolt would most likely be associated with high water backwater of the Snoqualmie River.

The elevation of future floods depends upon the level of the Snoqualmie River at the peak discharge of the Tolt River, the amount of landfill or diking, the physical arrangement or layout, and the hydraulic conditions of the channel.

High water marks were provided by landowners and field estimates of survey crews. There are no precipitation gages with long records in the watershed, but the Seattle Water Department has 8 storage gages established in 1962-67. The average annual precipiation at these locations ranges from 90 inches (228.6 cm) to 157 inches (398.8 cm).

The largest historical flood since 1953 on the Tolt River near Carnation occurred in 1959 with a peak discharge of 17,400 cfs.

The Raging River is characterized by a relatively steep gradient resulting in high-velocity floodflows and significant bank erosion and channel aggradation problems. These characteristics have lead to increased flood levels, based on local resident accounts, most likely caused by reduction in channel floodflow conveyance capacity with aggradation. In past floods, large boulders, logs, and debris have been swiftly transported down the river and have partially blocked bridges and threatened the levee systems in the Fall City area.

The peak recorded published flow at the USGS gage near Fall City during 40 years of gage operation through 1985 is 3,960 cfs. This occurred on January 24, 1984, and was approximately a 35-year event. Although final estimates of peak flows for a recent event on November 24, 1986, are not available, provisional estimates between 4,400 and 5,300 cfs have been made by the USGS (Reference 22). Based on the existing frequency curve previous to that event, those flows would correspond with greater than a 50-year event. Flows in excess of 3,000 cfs were also recorded on February 9, 1951, December 3, 1975, and December 15, 1979 (recurrence intervals ranging from 20 to 30 years).

Flooding damage to crops and property in the lower Green River Valley has been a problem since the earliest settlement of the area. Flooding occurred almost annually but the impact to the farmland was minimal. After urbanization, the impact of flooding became more severe. Rapid increase in construction of roads, housing, and parking lots increased the volume and rate at which runoff reached the valley floor. Commercial and industrial landfills have been typically located in the lower valley, resulting in alteration of natural drainage patterns and reduction in overbank storage.

During periods of excessive precipitation, surface and subsurface runoff from the steep valley walls cause groundwater elevations in the valley floor to rise significantly. This creates open ponding in topographically depressed areas. This condition is further aggravated by floodflows and corresponding high water elevations on the Green River, resulting in a perched channel condition, which prevents natural drainage of subsurface water. In some areas, the overlying soils are generally less pervious than the deeper sands and runoff collects in ponds perched above the water table.

The land in the lower Green River Valley from Auburn to Renton had historically been inundated by large floods, such as occurred in December 1933, November 1959, and February 1951, until the construction of the Howard A. Hanson Dam. Since operation commenced in 1962, the dam, in combination with levee systems constructed along river segments below Auburn, has prevented that degree of flooding and limited flood damages. During the floods of January 1965, December 1975, and December 1977, discharges downstream were effectively reduced to nondamaging levels. The 1977 flood would have had the highest unregulated peak of any event since diversion of the White River in 1906 (Reference 23).

The COE is responsible for regulation of dam outflows to a rate that will limit flows at Auburn, together with local inflows below the dam, to 12,000 cfs for up to a standard project flood frequency. This flow rate represents a 2-year recurrence interval flood event on the unregulated discharge frequency curve (Reference 24).

Under regulated conditions, significant flooding still does occur in areas unprotected by levee systems and from interior local drainage runoff that outlets to the Green River. High water levels in the Green River and concerns with existing levee system freeboard and structural integrity limit the discharge of runoff waters carried by Mill Creek (Auburn), the Black River, and various other tributaries. The high water levels of the Green River require that the tributary flows be stored and released by gravity or pump discharge to the river channel in a manner consistent with the requirements of the Green River Management Agreement (Reference 25). Under existing conditions, extensive backwater flooding occurs at the uncontrolled outlets of Mill Creek (Auburn) and Mullen Slough, south and west of State Routes 516 and 167, respectively.

The P1 pumping station pumps the flow from the Black River into the Green River. The firm capacity of the pumping station is significantly less than the peak inflows from Springbrook Creek estimated to reach it. No major backwater effects and associated flooding of overbank areas has occurred (Reference 26) since the pump station construction in 1972 and later P1 storage pond excavation. However, analysis shows that backwater flooding will occur upstream of the pump station under existing inflow runoff assumptions and hydraulic structure conditions. Peak outflows from the pump station have not exceeded 525 cfs (November 1986 event) with nominal P1 pond storage (Reference 26).

Flooding from the Mill Creek (Kent) drainage, downstream of the Earthworks Park regional stormwater detention basin, results primarily from limited capacity hydraulic structures and low stream gradients, extending downstream to its discharge to Springbrook Creek. Downstream of James Street, east bank overflow will occur at peak flood stages of Mill Creek and flow to the headwaters of Springbrook Creek. Although no stream gage records exist for Mill Creek, outflow from the Earthworks Park detention basin for the January 1986 storm event was estimated to be approximately 90 cfs, computed from surveyed high water mark data and hydraulic rating of the outlet.

Flooding in the Mill Creek (Auburn) drainage is caused by backwater effects from the Green River, and by overburdened channel capacities and restrictive hydraulic capacities at various roadway culvert crossings. During times of high flood stages on the Green River, which can extend from a few days up to a 1-week period for an extreme storm event, storage of Mill Creek floodwater along the valley floor behind the leveed Green River occurs. A portion of the flow, which would normally enter the Green River via Mill Creek, overflows into Mullen Slough for release back to the Green River, as it recedes, at a lower (downstream) hydraulic gradient.

No continuous stream gage records exist within the Mill Creek basin. Crest stage gage records between 1950 and 1970 on the Peasley Canyon tributary drainage indicate a peak recorded discharge of 112 cfs in February 1951 (Reference 27). Mill Creek peak runoff for the January and November 1986 runoff events was not considered extreme based on local accounts and field reconnaissance of extent of flooding.

Flooding along Big Soos Creek is primarily limited to the lower gradient channel reaches in the mid to upper portion of the basin, extending upstream from Kent-Black Diamond Road. Wide marshlands are typical in those reaches with narrow channels with limited hydraulic capacities. Restrictive bridges and other channel constructions exist that result in increased flood levels and corresponding flooding of the low-lying overbanks. Development does not currently encroach significantly on the floodplain.

The maximum recorded floodflow for Big Soos Creek for the 25-year period of record at the USGS stream gage station located above the fish hatchery near the Green River is 1090 cfs. That event occurred on February 28, 1972, and has an approximate recurrence interval based on period of record frequency curve computation of less than 10 years. Floodflows of greater than 1,000 cfs also occurred in November 1960, January 1964, and February 1982.

Preliminary estimates of peak flows for the January and November 1986 storm events do not exceed 900 cfs.

On the White River, the flood of 1975 overtopped and subsequently eroded a section of the levee on the left (south) overbank, upstream of the study area at approximately River Mile (RM) 10.6. It is unlikely that the levee will be repaired within the foreseeable future. Consequently, high flows on the White River are expected to cause flooding in the left overbank, outside the levee, for a distance of approximately 2.6 miles before floodwaters are returned to the main channel at approximately RM 8.0. Approximately 0.8 mile of this overbank flooding occurs within the Auburn corporate limits, inundating areas which are presently wooded and unclassified, but which are earmarked for future single-family residential development.

The amount of storage provided naturally by Lake Sammamish has a moderating influence on flow, and the channelization project by the COE has significantly reduced flood problems on the Sammamish River. The primary areas that are subject to flooding are adjacent to tributary inlets where the channel berm is interrupted.

On Lake Sammamish, the highest flood during a 37-year period of record occurred on February 11, 1951, when the water-surface to the lake reached an elevation of 33.44 feet National Geodetic Vertical Datum (NGVD). Calculations by the COE indicate that the 1951 inflow would have raised the lake elevation to 29 feet NGVD had the present improved outlet been in operation (Reference 28). On December 5, 1975, the lake level reached 29.70 feet NGVD. Generally, the lake level ranges between 25 feet NGVD in summer and 28 feet NGVD in winter.

The largest recorded floodflows on Swamp Creek occurred on January 18, 1986, when a flow of 1,090 cfs (provisional) was measured at the USGS gaging station at Kenmore. This flow exceeds the 100-year event magnitude based on the 23 years of gage record through 1986. The previous measured peak flow on Swamp Creek occurred on March 6, 1972, with a value of approximately 490 cfs.

Numerous private bridges along the lower reaches of Swamp Creek and encroachment on the creek channel from development provides restrictions to flow that may result in increased flood levels and additional overflows to typically low-lying overbank areas. Although localized flooding damages were reported for the January 1986 extreme runoff event, they were primarily related to channel bank erosion, overtopping of roadways and resulting damages (including culvert washouts), and limited damages to residential structures.

The natural channel of North Creek lies on the opposite side of the valley from where the stream now flows. The creek was relocated to the high side of the valley to improve its capacity. The last reported flooding on North Creek occurred in March 1950, when the flow reached 680 cfs. This event was slightly greater than the

100-year recurrence interval. Because land use in the valley is agricultural, the flooding had minimal impact. Highwater in December 1975 was reportedly contained within the North Creek channel. There are no gage records of this event. Localized ponding areas develop every winter because of the poorly drained soils in the valley.

Frequent flooding occurs on Little Bear Creek in the Woodinville area near the confluence of the Sammamish River. The hydraulic structures and channel capacities are limited along the stream reach between the culverts under NE 178th Street and State Route 202. This causes frequent overflows, primarily along the south bank, which are removed from the stream system and flow independently to the Sammamish River. South overbank flows, downstream of the State Route 202 culvert, combine with overflow immediately upstream of the same culvert and flood the low-lying Burlington Northern Railroad underpass area with ponding depths exceeding 6 feet. This overflow and ponding, with outflow across NE 175th Street south to the Sammamish River, frequently floods local commercial structures. Limited overflows along the north creek bank, upstream of NE 178th Street, cause shallow flooding to commercial structures and surrounding roadways, as was experienced in the January 1986 event. Flooding damages upstream of State Route 202 are not typically severe, primarily because of the undeveloped character of areas near the stream course and floodplain.

No operational stream gages exist on Little Bear Creek to directly estimate flooding magnitudes; however, analyses of hydraulic ratings for the channel, culvert, and overflow components provided an approximate peak flow estimate of 650 cfs for the January 1986 event. Review of local precipitation records and comparison with, and transfer of, flow records from adjacent gaged basins indicates that the event most likely represented a recurrence interval of greater than 100-year magnitude. A private commercial business crossing between the State Route 202 crossing and NE 178th Street was washed out during that flooding event.

The flood season for Bear and Evans Creeks is from October to March. The greatest floods are caused by rainstorms although melting snow may occasionally augment flooding. Storm runoff in the Bear Creek basin is comparatively slow because of the moderate terrain, the unimproved condition of the channels, and the small amount of residential and commercial developments in the watershed. As a rule, the stream rises to a peak stage within a day and the duration of flooding is less than a week.

The largest recorded floodflow on Bear Creek within the limited period of gage record was a recent event on January 18, 1986, with estimated provisional peak flows of 390 cfs at the USGS gage near Redmond (upstream of Cottage Lake Creek) and 1,550 cfs at the USGS gage at Redmond, upstream of the Sammamish River confluence. Based on updated frequency curves including that event, the estimated recurrence interval of floodflows within the Bear Creek basin for that event is approximately 40 to 50 years. The previous recorded peak flows at those gages were 250 cfs and 456 cfs, respectively, although the gage record is limited to 8 years for each station.

There are numerous bridges over Bear Creek within the study area, many of them private crossings with restrictions that limit capacities and increase upstream flood levels. During major floods, debris collecting at these structures may significantly increase the extent of flooding and potential for overflow with resulting damages to roadways and adjacent structures. Damage reports from the January 1986 event were not extensive; however, roadways were overtopped at a few crossings and a mobile home park was flooded and had to be evacuated along the lower reaches of Bear Creek.

The flood season for Issaquah and Tibbetts Creeks is during the winter from October to March. The greatest floods are caused by rainstorms although melting snow occasionally augments flooding. The creeks rise quickly during heavy rainfall because of the steep terrain in the watersheds. As a rule, the streams rise to crest stage within a day and the duration of flooding is less than a week.

The largest recorded peak floodflow on Issaquah Creek in 23 years of USGS gage record since 1964 occurred on November 24, 1986, when a peak discharge of 3,050 cfs (provisional) was recorded at the USGS gage "near mouth, near Issaquah" (Reference 22). That floodflow represents an approximate 25-year recurrence interval based on frequency curves for gage record prior to that event. The flooding event of January 18, 1986, produced the third highest period of record gage flow on Issaquah Creek, estimated at 2,400 cfs (provisional) by the USGS (Reference 29), with an estimated recurrence interval of less than 10 years. Peak runoff for a January 1, 1964, event of 2,870 cfs represents the second highest flow on gage record.

There are numerous bridges spanning Issaquah Creek. The clearance and flow capacity of many of these bridges are restricted. During major floods, debris collecting at these structures may significantly increase the extent of flooding. Development along Issaquah Creek has encroached on the channel, particularly in the downstream reaches in and surrounding the City of Issaquah. This encroachment reduces the flood-carrying capacity of the channel, increasing the flood depths in adjacent areas. Local accounts and aerial photographs (Reference 29) of flooding in the City of Issaquah and along the West Fork Tributary indicated that flood levels for the November 1986 event were the highest in recent years. Numerous roads and structures were inundated. Peak floodflows from the West Fork of Issaquah Creek are relatively small compared to those of the mainstem; however, significant areas of flooding occur in the upper reaches of that tributary. The flooding is a result of an extremely low gradient stream channel, having a small channel capacity with wide and flat overbanks.

Flood damage on May Creek occurs mainly at the mouth where a lumber mill has been built on the small delta there. Upstream of Interstate Highway 405, May Creek flows generally within a canyon. Flooding problems in this reach are the result of surface runoff and ground-water seepage from the steep canyon walls rather than excessive overflow of May Creek.

For the reach of May Creek under study upstream of the Coal Creek Parkway, flooding results from channel and bridge capacities restrictions and flattening of stream gradients in the upper May Valley area. For the reach extending upstream to 146th Avenue SE, flooding is typically confined to a relatively narrow, steep channel. Upstream from that crossing, the floodplain expands to the overbanks where floodplain inundation widths between 500 and 1,000 feet are typical for significant storm events. Filling of floodplain overbanks and reduction in storage, and debris buildup at the hydraulic structures, can increase flood levels and the extent of upstream overbank flooding. Flooding extent on the May Creek Tributary, upstream of SE May Valley Road, results primarily from backwater effects of the main channel at their confluence.

A USGS stream gage exists on May Creek (discontinued) at its mouth near Renton. The peak flow recorded at that station during the 15 years of gage operation was 510 cfs on December 3, 1975. This corresponds to a storm with a recurrence interval of approximately 10 to 15 years based on the period of record frequency curve. High water marks located immediately upstream and downstream of the gage were observed for the January 1986 storm event. Results of approximate rating analyses at the gage for that event indicated floodflows potentially exceeding 800 cfs with an expected recurrence interval of greater than 50 years. Flooding, including inundation of structures in the upper May Valley area, were reported for that event.

Flooding along Vasa Creek generally occurs during the winter months, November through February, when storms originating over the Pacific Ocean bring intense precipitation. These storms usually last two or three days, and streams may increase from low flow to flood discharge within 6 to 12 hours. The major flood problems are those of inundation and damage of private property from out-of-bank floodwaters, primarily along low gradient reaches of the streams.

The Cedar River is subject to frequent flooding damages, particularly in its upper reaches, beginning with minor flooding and bank erosion when the river flow, measured at Landsburg, exceeds 2,500 cfs. This magnitude of flows typically occurs annually. Major flooding occurs when river flows reach 4,000 cfs, which happens on the average once every 5 to 10 years. Topographic and climatic conditions of the basin produce two high-water periods during the year. The highest flows normally result from extreme rainfall and the accompanying snowmelt that can occur during the late fall and early winter. Flooding can also occur during spring months, resulting primarily from snowmelt events.

Stream flow on the Cedar River has been recorded almost continuously since 1895 at the gage near Landsburg. The greatest flood which has occurred over the past 50 years took place on December 4, 1975, with a peak discharge at Landsburg of 8,800 cfs. Based on an updated frequency curve for the Renton USGS stream gage for the 40 years of record through 1985, the recurrence interval for that event exceeded 100 years. Preliminary peak flow estimates by the USGS (Reference 22) for the recent November 1986 event indicate a peak flow of approximately 5,300 cfs, with a recurrence interval of approximately 100 years. Preliminary peak flow estimates by the USGS (Reference 22) for the recent November 1986 event indicate a peak flow of approximately 5,300 cfs, with a recurrence interval of approximately 10 years.

Damages in the Cedar River basin from the December 1975 flood event were estimated at $1,760,000. In the reach under study, the west bank of an improved channel at the mouth of the Cedar River was overtopped above the South Boeing Bridge and the Renton Municipal Airport experienced significant flooding and had to close down until the floodwaters receded. Extent of flooding for the November 1986 event in the lower 2-mile reach under study was mainly limited to the improved channel with the exception of some overbank flooding adjacent to the Renton Airfield. Upstream of the improved channel, portions of the Maplewood Addition and other scattered residential developments have been inundated by past flooding events. Log and debris jams have been experienced on the lower river channel, especially during the 1933 and 1975 floods.

The lower reach of the river channel, through the City of Renton, has been aggrading in recent years based on comparison of current and previous cross section data. This may result in increases in flood levels and potential overflows.

A reach of the Cedar River about 0.8 mile in length along the right bank immediately upstream of Interstate 405 highway is seriously obstructed. Various private enterprises along this river reach have encroached on the stream bed by dumping waste concrete and asphaltic concrete. A fill has been placed, paved, and riprapped to accommodate parking facilities for tenants residing at the Riveria Motel. This fill encroaches into the river 25 to 40 feet along the entire width of the property. Encroachment of this type reduces the river channel capacity, creating higher water levels adjacent to and upstream of these areas.

Flooding along Mercer Creek, Richards Creek and its tributaries, Kelsey Creek and its tributaries, and North Branch Mercer Creek generally occurs during the winter months, November through February, when storms originating over the Pacific Ocean bring intense precipitation. These storms usually last two to three days and streams may increase from low flow to flood discharge within 6 to 12 hours. The major flood problems are those of inundation and damage of private property from out-of-bank floodwaters, primarily along low-gradient reaches of the storms.

Ice jams have little impact on flooding when culverts and bridges are free of debris. Flood elevations, however, are increased due to the limited capacity of some culverts. This limited capacity in some cases is intentional as a means of peak-flow retention.

Numerous bridges and culvert systems exist along Thorton Creek from its outlet to Lake Washington at Matthews Park to its forks and extending upstream to and above Interstate 405. Flooding for moderate runoff events is primarily contained by the Thornton Creek drainage system. However, the restrictions imposed by the crossings and encroachment on the channel in this heavily urbanized basin result in backwater flooding and overflow of channel banks and structures, with resulting damages, under more severe runoff conditions. Debris collection, particularly as it affects outflow to the diversion works, has had significant impacts on increasing inundation levels during past flooding events. Since the November 1978 storm event that resulted in flooding problems augmented by debris, the City of Seattle has improved the operation and maintenance of the diversion works structure, located at RM 1.3 on Thornton Creek, below the confluence of the North and South Forks. This diversion works structure diverts flows up to an estimated 340 cfs for the 100-year event into an abandoned 72-inch concrete sewer pipe. This pipe discharges directly into Lake Washington just north of Matthews Beach. The diversion structure functioned adequately during the January 1986 storm event. Based on hydraulic rating analyses performed from surveyed high water marks, peak runoff for that event was estimated at 560 cfs above the diversion and downstream of the creek forks and 220 cfs in the main channel downstream of the diversion works.

Some minor flooding has occurred in the past in the lower reaches of McAleer Creek. This flooding was caused by hydraulic structures of inadequate capacity or sedimentation and debris accumulation. Particular dates of past flooding are not available.

Flooding along Coal Creek generally occurs during the winter months, November through February, when storms originating over the Pacific Ocean bring intense precipitation. These storms usually last two to three days, and streams may increase from low flow to flood discharge within 6 to 12 hours. The major flood problems are those of inundation and damage of private property from out-of-bank floodwaters, primarily along low gradient reaches of the streams.

The flood season for Forbes Creek in the lower Puget Sound region is normally during the winter from October to March. The larger floods are caused by rainfall, although melting snow occasionally augments flooding.

Forbes Creek has no gaging station and there is no written record of historical flooding. Discussions with residents revealed a history of localized flooding of short durations caused by brief periods of intense rainfall.

Debris collecting at structures and residents encroaching on the channel capacity by placing various types of materials to stabilize the streambank, may significantly increase the extent of flooding.

Flooding along Lyon Creek has occurred in the lower reaches and also in the southwest corner of NE 185th Street and 35th Avenue NE nearly every winter. Hydraulic capacity has been greatly reduced in the two concrete box culverts under Bothell Way Northeast. Sedimentation in the southern portion, up to approximately 2 feet from the original invert, has diverted all the flow through the northern portion. At higher flows this would create unnecessary backwater in the upstream channel in front of the shopping center complex or the sediment could become dislodged causing a blockage elsewhere downstream.

Flooding along Yarrow Creek, Meydenbauer Creek, and North Fork Meydenbauer Creek generally occurs during the winter months, November through February, when storms originating over the Pacific Ocean bring intense precipitation. These storms usually last two to three days, and streams may increase from low flow to flood discharge within 6 to 12 hours. The major flood problems are those of inundation and damage of private property from out-of-bank floodwaters, primarily along low-gradient reaches of the streams.

The major source of flooding within Skykomish is the South Fork Skykomish River. Flooding occurs primarily during the winter due to rainstorms which bring intense precipitation and are accompanied by warm winds that rapidly melt the accumulated snowpack. During such storms, river discharges may increase from a relatively low base flow to near flood stage within a few hours.

Residents report that the largest flood on record occurred in November 1959. The return period for that flood is approximately 30 years. Although a dike contained most of this flow in the eastern part of the town, water covered the central and western areas. A flood also occurred in 1975, and floodwaters reached the tops of the levees. The return period for that flood is less than 3 years.

The other potential source of flooding within Skykomish is Maloney Creek, which meets the South Fork Skykomish River near the western corporate limits. This stream flooded in 1933 when a logjam that had been holding back the flow broke. No information on the recurrence interval for this flood is available. There has been no flooding reported on Maloney Creek since that time.

The flooding problems in the lower portions of Miller and Walker Creeks are a result of increasing development, which has caused more rapid runoff in those creeks. This development is primarily outside the City of Normandy Park boundary and has been the subject of much discussion and some litigation. Damage has generally been limited to stream erosion and some limited flooding around residences.

The area most subject to flooding along the lower portions of Des Moines Creek is owned by the Covenant Beach Bible Camp.

The streamflow of Des Moines Creek exceeds the channel capacity several times each year, resulting in several thousands of dollars of damage each year. Damage is usually limited to bank erosion, overbank deposition, and some shallow flooding in and around occasionally occupied camp cottages.

The last major flood event along Miller and Des Moines Creeks was in February 1972, and had a recurrence interval estimated at 10 years. As a result of Miller Creek flooding, a suit was brought against the county to restrict the diameter of the 8-1/2 foot culvert on First Avenue South through which Miller Creek passes. A 6-foot diameter collar was placed in the upper end of the culvert. The effects of the collar have been included in the hydraulic analysis of Miller Creek. As a result of Des Moines Creek flooding, a 4-foot-deep hole was eroded around one of the cottages and water up to approximately 2 feet deep was standing in others. The December 15, 1977, high tide provided a high tide in Puget Sound of an approximate recurrence interval of 70 years. This high tide was accompanied by very little wind.

Flooding occurs at numerous locations along Longfellow Creek because of restricted channel and culvert capacities and partial obstruction of the natural channel because of debris accumulation. Overtopping of the majority of the roadway crossing between SW Brandon Street and SW Myrtle Street, including localized flooding of properties, structures, and bank erosion, occurred during the January 1986 flooding event. Downstream of the study limit, flows at SW Nevada Street overtopped an approximate 30-foot-high roadway fill, partly because of culvert debris blockage, and resulted in failure of that crossing with extreme floodflows released to the downstream drainage. Surface flooding also occurs at locations where the lateral storm drainage systems have insufficient capacity to convey storm runoff into Longfellow Creek.

The existing culverts that convey Rolling Hills Creek under Interstate 405 at its intersection with State Route 167, and through a closed culvert behind the Renton Cinema, cause overbank flooding north of the channel in the parking areas for the Cinema and the Renton Village Development. Significant reduction in peak flows through the downstream highway culvert is achieved from routing of floodwaters that pond in the overbank.

2.4 Flood Protection Measures

The Seattle office of the National Weather Service maintains and collects hydrometeorological reports from a network of substations and uses this information to prepare flood forecasts for King County streams. Flood warnings are issued by them and given wide dissemination through all media by cooperative efforts with local and Federal agencies.

Levees on the Tolt River, near its confluence with the Snoqualmie River, provide moderate protection to urban development in the City of Carnation and to adjacent agricultural lands. A 600-acre agricultural area on the left bank of the Snoqualmie River, 1 mile downstream from Fall City, is protected from minor spring floods by a levee approximately 1 mile long. Levees along the lower 2 miles of both banks of the Raging River and its confluence with the Snoqualmie River protect a portion of Fall City and agricultural lands. Levees along the South Fork of the Snoqualmie River provide approximately 50-year flood protection to the City of North Bend.

Bank erosion occurs at nearly all river stages, but is most severe during medium and high flows. Bank protection projects have been constructed at numerous locations along the Snoqualmie River and its major tributaries by riparian owners, local governmental agencies, and the Federal government.

In 1960, the City of Seattle constructed a water supply project on the South Fork of the Tolt River. Total storage capacity of the reservoir is about 58,000 acre-feet. Although flood control storage is not a project feature, some minor storage of flood discharges does occur.

The COE operates the Howard A. Hanson Dam at Eagle Gorge on the upper Green River. Completed in 1962, the dam provides approximately a 500- to 600-year level of protection against overbank flooding by the Green River. The dam is a rockfill embankment approximately 235 feet high with a gated spillway and a maximum reservoir elevation of 1,222 feet. Stored water is released as soon as possible after a flood to provide for the possibility of a second flood. The COE current operation of Hanson Dam provides that all runoff is passed through the dam until the flow at the Auburn gage is expected to reach 12,000 cfs. At that point, further releases are regulated to maintain no more than 12,000 cfs at Auburn.

Channelization and levee construction, primarily downstream of Auburn, has provided additional flood protection for the overbanks. A total of approximately 16 miles of levees have been constructed in addition to roadway systems that function as levees, between State Route 18 at Auburn and the Black River confluence at Tukwila.

Based on information received from the COE, the levee system along the left (west) bank of the Green River, from Strander Boulevard to RM 16.7, in the City of Tukwila, will adequately provide protection against overtopping or failure caused by the 100-year flood, with at least two feet of freeboard.

King County and the various incorporated citied along the Green River (Tukwila, Renton, Kent, and Auburn) are responsible for maintenance of portions of those levee systems. Since the adoption of enabling legislation by the State of Washington in 1945, the State and King County have combined to control riverbank erosion.

The Black River basin, including Springbrook Creek, has been the object of the ongoing East Side Green River Watershed Study (Reference 30). That study was initiated in 1965 by the SCS with the support of King County and the Green River Valley cities. The P1 pumping station and storage pond, as part of the plan, were constructed in 1972 and 1984, respectively. A major box culvert replacement was installed at SW Grady Way in 1986 and is considered in this study in its partially obstructed condition. Preliminary plans exist for the construction of the P1 channel from SW Grady Way north to the storage pond and additional culvert replacements under Interstate 405 and SW 16th Street. The timing and funding for construction of these improvements is not finalized; therefore, they are not considered in this study.

A regional detention basin was constructed on Mill Creek (Kent) in 1981 at Earthworks Park in order to provide flood control storage for reduction in downstream peak runoff. A second smaller upstream detention basin was previously constructed in the Upper Mill Creek basin to provide for additional reduction in peak flows to the lower valley areas. This has reduced the magnitude and frequency of, but not eliminated, flooding problems downstream of the Earthworks Park structure. The City of Kent is developing a plan to construct more detention storage in order to further alleviate their flooding problems.

Partial reduction in peak runoff conveyed to Mill Creek (Auburn) is provided by stormwater detention storage basins constructed on the south tributary to Mill Creek, above its confluence with the Peasely Canyon tributary. Locally referred to as the "Auburn 400" ponds, and located east of and adjacent to State Route 167 and 15th Street SW, they provide an unidentified effect on routing of peak tributary flows to Mill Creek. Additional regional detention storage is being considered for other study reaches of Mill Creek, downstream of State Route 18, in an attempt to maintain adequate storage capacities for limiting downstream discharges with continued floodplain development.

On the White River, peak flows are regulated by the Mud Mountain Dam, a structure built by the COE. Storage was initiated in 1942, and the project was finally completed in 1953. The structure is an earth and rockfill dam, 425 feet above bedrock. The reservoir has a storage capacity of 106,000 acre-feet of water and is capable of controlling floods 50 percent greater than the maximum flow of record.

Levees have also been constructed along portions of the White River along its course through the Cities of Auburn and Pacific.

The amount of storage provided naturally by Lake Sammamish has a moderating influence on flow, and the channelization project of the Sammamish River by the COE has significantly reduced flood problems. Major drainage improvement and partial flood protection are provided by the channel improvement project completed in 1966 by the COE for King County. The project extends from below Lake

Sammamish to Kenmore, a distance of approximately 14 miles. The river channel was deepened an average of 5 feet and increased in width from a former average of about 15 feet to the improved 32 to 50 feet. Excavated material from the channel enlargement was used to construct the levees. A low weir with a crest elevation of 24.5 feet NGVD was constructed to control the outlet of Lake Sammamish. The channel improvement and outlet project provide protection against spring floods with a recurrence interval of 10 years without causing Lake Sammamish to rise higher than elevation 29.0 feet NGVD. No significant flood control measures have been developed on the Sammamish River tributaries except for channelization of the lower end of Bear Creek at Redmond (Reference 28).

Most of the channel of May Creek is in its natural condition. The lower 1,000 feet have been channelized to alleviate flooding problems caused by channel aggradation resulting from excessive siltation problems.

King County has established a flood fighting plan that is activated when the Cedar River reaches a discharge of about 4,000 cfs at Renton. The plan consists of patrolling and making emergency repairs to contain this discharge. When the flow exceeds 4,000 cfs, efforts are concentrated on protecting the safety of the affected residents and their personal property. The Sheriff's office, the Office of Civil Defense, fire districts, and the Red Cross are notified for assistance.

The lower 1-mile reach of the Cedar River channel was initially stabilized in 1912. King County and the City of Renton have provided major capital improvements and maintenance for flood and erosion control along the Cedar River. This has included riprap bank protection works, bulkheads construction, cleaning, and snag removal. Major reconstruction of levees and bank protection work was accomplished after the December 1975 flood. River channel dredging upstream from the mouth of the Cedar River has been performed, most recently in 1972, in an attempt to maintain 100-year flood protection of the improved channel system through the City of Renton.

The major flood control improvement to Thornton Creek is the diversion works with a 72-inch overflow pipeline to Lake Washington. The diversion reduces the peak flows to the lower mainstem reach of Thornton Creek such that only minimal downstream flooding hazards exist up to a 100-year frequency existing conditions flooding event. This assumes that full unobstructed capacity is maintained to the diversion pipeline.

In 1946, the COE constructed a levee along the south bank of South Fork Skykomish River in Skykomish. This levee is approximately 970 feet long and provides variable flood protection to a portion of the town.

A flood protection structure that significantly influences flooding on Des Moines Creek is the road embankment from Marine View Drive located in the City of Des Moines, which creates enough detention storage to reduce the peak 100-year flood by almost 50 percent on Des Moines Creek.

In 1983, the City of Seattle constructed a regional stormwater detention basin on Longfellow Creek south of SW Webster Street. The detention basin has helped reduce downstream flooding problems, although basin overflow for more severe storms, as evidenced in the January 1986 event, will reduce the basin's effectiveness on reduction in peak flows.

There are no other flood control measures for other streams studied that significantly reduce flooding.

3.0 ENGINEERING METHODS

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

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

For those flooding sources being restudied or that are extensions of previous detailed riverine studies, peak discharge results presented in the previous Flood Insurance Studies for King County and the Cities of Auburn, Kent, and Renton (References 1, 2, 8, and 15) were compared with updated discharges estimated to determine the appropriate values to be used in this revised study. The peak discharge estimates assume that existing basin hydraulic structures remain unobstructed and existing upstream dams or impoundment structures remain intact with no changes in operating characteristics.

Discharge-frequency for the Snoqualmie River, South, Middle, and North Forks Snoqualmie River, Sammamish River, North Creek, Bear Creek, Evans Creek, Issaquah Creek, North and East Forks Issaquah Creek, Tibbetts Creek, Vasa Creek, Cedar River, Mercer Creek, Right Channel Mercer Creek, Richards Creek, East and West Tributaries Richards Creek, Kelsey Creek, West Tributary Kelsey Creek, East Branch of West Tributary Kelsey Creek, North Branch Mercer Creek, McAleer Creek, Coal Creek, Lyon Creek, Meydenbauer Creek, North Fork Meydenbauer Creek, South Fork Skykomish River, Maloney Creek, and the Tolt River were developed from USGS stream gaging stations on the respective streams by applying the standard log-Pearson Type III methods with the expected probability corrections as outlined by the U.S. Water Resources Council (Reference 31).

Discharge-frequency relationships in the revised study for Raging River, Issaquah Creek, Cedar River, Swamp Creek, May Creek, May Creek Tributary, and Big Soos Creek were developed from streamflow records at USGS gages within those watersheds. The gage reference numbers, descriptions, and periods of record (Reference 32) used in the analyses are summarized below. That listing includes additional gages used for correlating and transferring flows between local, hydrologically similar basins or for comparison of results. The Flood Flow Frequency Analysis computer program (Reference 15) was used to determine the discharge-frequency relationships by applying log-Pearson Type III analysis techniques in accordance with methods presented in USGS Bulletin 17B (Reference 33) to the annual peak flow data for each gage site.

USGS GAGES

Flooding Source	USGS Gage Ref. No.	USGS Gage Description	Period of Record
Snoqualmie River	12-1490	Near Carnation	1930-1965
N/A		Near Snoqualmie Falls	1929-1965
12-1445000		Near Snoqualmie	1959-1978
South Fork Snoqualmie River	N/A	At North Bend 1918-26, 1930-38, 1946-50, 1961-78	1911-12, 1914-16,
North Fork Snoqualmie River	N/A	Near North Bend 1920, 1922-26, 1930	1910-12, 1914-18,
Middle Fork Snoqualmie River	N/A	Near Tanner	1962-1978

Raging River	12-145500	Near Fall City	1946-1985
Tolt River	12-148500	Near Carnation	1959-1971
Green River	N/A	Near Tukwila	1959-1963
N/A	Near Auburn		1937-1962
N/A	Near Black Diamond		1940-1948
N/A	Near Palmer		1932-1962
N/A	Near Lester		1946-1962
Big Soos Creek	12-112600	Above Hatchery, Near Auburn	1961-1986
Sammamish River	1250	At Bothell	1940-1963
	N/A	Near Redmond	1940-1957
Swamp Creek	12-127100	At Kenmore	1964-1986
Little Bear Creek	12-126000	North Creek, Near Bothell	1946-1976, 1986
Bear Creek	12-122500	Near Redmond	1946-49, 1980-81, 1986
	12-124500	At Redmond	1946-50, 1956-58, 1986
	12-124000	Evans Creek, Above Mouth Near Redmond	1956-1977
Issaquah Creek	12-121600	Near Mouth	1964-present
	12-121000	Near Issaquah	1946-1964
Tibbetts Creek	12-121700	Near Issaquah	1964-present
May Creek	12-119600	At Mouth, Near Renton	1965-1979
Cedar River	12-119000	At Mouth	1946-1985
	12-1175	Near Landsburg	1948-present
McAleer Creek	12-1276	At Lake Forest Park	1963-72, 1973-74
Lyon Creek	12-1273	At Lake Forest Park	1964-68, 1969-75
Mercer Creek	N/A	At Bellevue	1945-present
Coal Creek	N/A	At Bellevue	1963-present
North Branch Mercer Creek	N/A	At Bellevue	1949-present
South Fork Skykomish River	12-1330	Near Index	69 years
	12-1305	Near Skykomish	26 years
Beckler River	12-1310	Near Skykomish	28 years

Discharge-frequency relationships established for gage locations were transferred to selected runoff concentration points along the study reaches through the application of regional regression techniques per published regression equations (Reference 34).

USGS gage flow records from the adjacent, hydrologically similar North Creek basin were used to establish flow estimates for Little Bear Creek. Evaluation of peak recurrence interval discharges in the lower reaches of Little Bear Creek, downstream of the State Route 202 crossing, include reductions in main channel flow to reflect overflows away from the main channel that enter the Sammamish River at other locations.

Updated hydrology for flooding sources either being restudied or that are extensions of existing detailed studies were compared using statistical confidence limits with existing published Flood Insurance Study discharges at identified locations. Comparison of peak discharge estimates for the May Creek gage site with those published in the previous Flood Insurance Study for the City of Renton indicated no significant statistical differences. Therefore, in accordance with FEMA guidelines, the previous flow estimates for the gage site have been used in the present study.

Recurrence interval peak discharge estimates established for the added detailed study reach of Bear Creek, upstream from its confluence with Cottage Lake Creek, are based on the results of the statistical analysis of annual peak flows at USGS gage No. 12-122500 near Redmond. The limited period of gage record (8 years, including January 1986 event provisional flow estimates) would normally preclude analysis using this method. However, additional gages located on Cottage Lake Creek (No. 12-123000), Evans Creek (No. 12-124000), and on the downstream reach of mainstream Bear Creek, (No. 12-124500) provided adequate data for comparative assessment of results.

Discharge-frequency relationships for Thornton Creek, Longfellow Creek, Mill Creek (Auburn), and Rolling Hills Creek were developed using the COE HEC-1 computer program (Reference 35). The basic application of this synthetic hydrograph model included computation of drainage subbasin runoff hydrographs using the SCS Type 1A storm distribution (Mill Creek and Rolling Hills Creek), routing of those hydrographs through channel reaches and detention storage areas, and combining them with downstream subbasin hydrographs at selected study reach runoff concentration points. Calibration of those models to discharge estimates, developed from high water mark data collected for the January 1986 event, was performed.

Peak-flow estimates for Thornton Creek include consideration of unobstructed diversion of flows to the overflow pipeline to Lake Washington. Runoff estimates for Thornton and Longfellow Creeks used a multiple peak design storm distribution pattern based on the actual January 17 through 19, 1986, storm event, taken from a network of local precipitation gage data (Reference 36). In addition to localized culvert backwater routing effects, routing of flows through the SW Webster Street detention basin and outlet structure was included in the Longfellow Creek modeling analyses. Discharge estimates computed at the mouth of Mill Creek (Auburn) consider noncoincidence of peak flows in the Green River and Mill Creek. Storage routing effects of backwater storage at the location have therefore not been considered in this analysis. Discharge estimates for Mill Creek for the floodway determination were modified to reflect reduction in storage with encroachment on the storage provided by the natural floodplain.

Recent modeling analyses of the Mill Creek (Kent) and the Springbrook Creek basins using the SCS TR-20 hydrograph program have been performed by a local consultant for the City of Kent Drainage Master Plan (Reference 37). That study developed 25- and 100-year recurrence interval discharge estimates based on a 12-hour duration, SCS Type 1A storm distribution for the valley floor basins. It included consideration of significant storage-routing components within the Mill/Springbrook Creek system, including the recently completed Earthworks Park stormwater detention facility. The discharge estimates presented in the City of Kent Drainage Master Plan and supplemental computer output files, for existing land use conditions have been accepted for use in this restudy. Additional recurrence interval flows were extrapolated from the computer flows. The resultant flow estimates were reduced by overflow estimates to Springbrook Creek north of James Street, computed using hydraulic backwater rating methods, to provide the downstream estimates.

Stream gage records are not available for the Black River and Springbrook Creek. In the absence of gaged discharge data for statistical determination of peak flow estimates, information from several previous hydrologic modeling studies within the Black River basin were collected and reviewed for comparison of results and for determination of acceptability for use in the restudy. Synthetic unit hydrograph modeling of basin runoff has been performed by the COE using the HEC-1 Flood Hydrograph model (Reference 38); the SCS using the TR-20 model (Reference 39); by the previous study contractor for the existing Renton Flood Insurance Study using the TR-20 model (Reference 15); and, more recently, by other consultants for upstream reaches of the basin, using the TR-20 model. The flow estimates from the previous Flood Insurance Study were determined to be the most representative of the conditions existing in the basin at the time of this restudy, and were therefore used. Since the previous Flood Insurance Study only calculated the 10- and 100-year hydrographs, the 50-year hydrograph was interpolated from those previously computed. The 500-year hydrograph was not analyzed because of the extensive changes in overbank storage that occur at P1 pond stages in excess on the 100-year recurrence interval.

The Green River basin has been studied extensively by the Seattle District of the COE. The COE operation of Howard A. Hanson Dam provides flow regulation for flood protection to the downstream river reaches, particularly the lower Green River Valley downstream from Auburn. Current COE operation of the dam regulates the peak downstream flow releases up to the standard project flood to 12,000 cfs at the USGS Auburn gage. This includes consideration of tributary inflows downstream of the dam (i.e., Newaukum Creek and Big Soos Creek). Discharge-frequency analyses have been performed by the COE as part of the Green River Flood Reduction Study (Reference 23) for estimation of peak unregulated and regulated floodflows at the Auburn steam gage. Results of those analyses were reviewed and used in this restudy. The flows are also in agreement with previously published Flood Insurance Study discharge estimates.

Discharge-frequency relationships for the White River were obtained from a backwater channel-capacity study by the COE (Reference 40). The selected stations were Mud Mountain Dam and the White River at the mouth. The peak discharges were adjusted for the White River near Auburn. Those adjusted discharges were used directly for this study.

Because there are no streamflow records on Forbes Creek and Yarrow Creek, runoffs for the floods of interest were calculated using rainfall relationships developed for the area and a computerized stormwater routing model. The model incorporates the unit hydrograph methodology developed by the SCS (Reference 41). The peak discharges obtained by this method were comparable to those derived from regional regression equations published by the USGS (Reference 42).

The hydrologic analysis of Miller and Walker Creeks in the Sea-Tac communities plan (Reference 43) used a stormwater management model developed in earlier river basin studies. A single large storm and measurements at temporary gaging stations along the creeks were used to calibrate the model, and flows for the 10-, 50-, and 100-year storms were computed. The 500-year flood was estimated by extending the curve through the computed points.

A gaging station on Miller Creek was established in 1973 to provide a better understanding of hydrologic conditions in the stream.

No gage records exist for Des Moines Creek. Because of highly similar drainage basin characteristics, peak discharges per square mile for Miller and Walker Creeks were applied to the Des Moines Creek drainage basin. These flows gave flood elevations well in excess of local experience. The excessive flow rates were explainable because an 80-foot-high road embankment (Marine View Drive) crosses Des Moines Creek Canyon at the upper end of the detailed study area. The box culvert flowing under the embankment has a capacity of 300 cfs before peak flow storage begins. However, even assuming that no outflow was allowed, the impoundment can store 65 percent of the runoff that would occur during a 6-day, 100-year storm. Therefore, reservoir routing capacity exists to significantly reduce peak flows. Utilizing rainfall-runoff data and techniques developed by the study contractor during a recent study of a similar urban area located several miles to the north, a 100-year synthetic runoff hydrograph was developed for a 6-day storm for Des Moines Creek.

The 100-year hydrograph was routed through the storage reservoir created by the road embankment, reducing the unrouted peak discharge. This same percentage of flow reduction was applied to the 10-, 50-, and 500-year unrouted peak flows.

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross section data for the backwater analysis for Miller Creek, Walker Creek, and a portion of Des Moines Creek were taken from topographic maps with 2 foot contour intervals (Reference 44). Cross section data for North Creek and White River (left bank overflow) were taken from aerial photographs (References 45 and 46). Cross section data for the Snoqualmie River and North, Middle, and South Forks Snoqualmie River were obtained from field surveys and aerial photographs (References 1, 47, 48, and 49). The cross section data for the backwater analyses for the remaining streams studied by detailed methods were obtained by field survey. Cross section data for the overbank areas of Green River, Tibbetts Creek, Issaquah Creek, and East Fork Issaquah Creek were based on topographic base maps (References 50 and 51).

The flooding potential, in the form of ponding, for the unnamed drainageway in the central business district in Kirkland, is directly related to the capacity of the existing stormwater drainage system. The capacity of this system was determined and removed from the runoff produced by the design storm. The volume of the remaining excess runoff was then compared to a storage-elevation curve developed for the central business district. This comparison yielded the maximum expected elevation for the predicted 100-year event. Based on a Letter of Map Revision (LOMR) dated January 30, 1989, and due to improvements done in that area, the drainageway was moved to reflect the LOMR.

Water-surface elevations of floods of the selected recurrence intervals on Mercer Creek, Right Channel Mercer Creek, Meydenbauer Creek, North Fork Meydenbauer Creek, Coal Creek, Vasa Creek, Richards Creek East Tributary, Richards Creek West Tributary, Kelsey Creek, West Tributary Kelsey Creek, East Branch of West Tributary Kelsey Creek, North Branch Mercer Creek, and Yarrow Creek were computed using the USGS E-431 step-backwater computer model (Reference 52). Water-surface elevations of floods of the selected recurrence intervals on Lyon Creek and McAleer Creek downstream of Northeast 178th Street were computed by hand calculations.

TABLE 1 - SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Snoqualmie River					
At mouth	693.0	42,000	54,000	60,000	68,000
At Duvall	645.0	42,480	54,610	59,610	71,530
At Carnation	603.0	46,800	65,200	73,000	92,000
Near Snoqualmie	375.0	52,300	71,000	78,500	95,500
Raging River					
At mouth	32.9	4,031	6,286	7,413	10,465
At USGS gage 12-145500	30.6	3,790	5,910	6,970	9,840
Above Interstate Highway 90	25.7	3,268	5,095	6,009	8,483
Above Lake Creek confluence	20.2	2,652	4,135	4,877	6,885
Above Deep Creek confluence	13.3	1,851	2,887	3,404	4,806
Middle Fork Snoqualmie River					
At Mouth	171.0	26,900	34,800	38,600	46,900
At Mt. Si Bridge	169.0	28,000	38,300	43,800	55,800
Middle Fork Upper South Overflow					
At divergence from Middle Fork	N/A	1,000	3,000	4,300	7,400
Downstream of divergence of Upper North Overflow	N/A	500	1,500	2,150	3,700
Middle Fork Upper North Overflow	N/A	500	1,500	2,150	3,700
Middle Fork Lower Overflow					
At divergence from Middle Fork	N/A	200	1,600	2,300	4,200
Downstream of divergence of Middle Overflow	N/A	100	1,100	1,400	2,600
Middle Fork Middle Overflow	N/A	100	500	900	1,600
North Fork Snoqualmie River					
At mouth	103.0	18,600	24,600	27,200	32,800
At North Bend gage	96.0	14,700	19,700	21,700	26,200
At Snoqualmie gage	64.0	12,300	16,300	18,000	21,700
South Fork Snoqualmie River					
At Mouth	86.8	10,100	16,500	20,200	28,600
At North Bend gage	81.7	9,000	13,000	15,000	19,700
At Edgewick gage	65.9	8,900	12,900	14,900	19,500
Green River					
At Renton	450.0	12,000[1]	12,000[1]	12,000[1]	12,000[1]
At Tukwila	450.0	12,000[1]	12,000[1]	12,000[1]	12,000[1]
At Kent	400.0	12,000[1]	12,000[1]	12,000[1]	12,000[1]
At Auburn	399.0	12,000[1]	12,000[1]	12,000[1]	12,000[1]
At USGS gage 12-113000 (Auburn)	339.0	12,000[1]	12,000[1]	12,000[1]	12,000[1]
Below Howard A. Hanson Dam	220.0	11,000[1]	11,000[1]	11,000[1]	11,000[1]
Above Howard A. Hanson Dam	215.0	20,050	29,250	33,500	49,000

[1]Discharges constant due to controlled release from Howard A. Hanson Dam

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Black River					
Above Green River confluence	24.8	400[1]	400[1]	400[1]	400[1]
At P-1 pump station inlet	24.8	650	1,040	1,230	1,730
Springbrook Creek					
Upstream of confluence with Black River	21.9	590[2]	930	1,100[2]	1,550
Downstream of confluence with Mill Creek (River Mile 3.03)	16.1	680[1]	--	1,055	--
Mill Creek (Kent)					
At confluence with Springbrook Creek	9.2	380	--	650	--
At Highway 167 culvert entrance	3.1	110	125	130	140
At Bowen-Scarff culvert outlet	2.9	110	115	120	130
Downstream of Springbrook Creek Overflow	2.7	85	90	100	110
At James Street	2.6	70	110	140	180
Mill Creek (Auburn)					
Above confluence with Green River	12.8	250	360	410	510
At 277th Street	11.7	230/220	330/320	370/360	480/470
At 37th Street, N.W.	9.8	200/190	290/280	340/320	500/420
At 29th Street, N.W.	8.9	180	270	310	450
At Valley Freeway (SR-167)	8.0	180/170	270/250	310/280	500/400
At 15th Street, N.W.	7.6	190/170	300/250	370/290	570/480
At Main Street	6.2	160	250	310	490
At Peasley Canyon Way	5.7	140	230	290	450
At 15th Street, N.W.	0.7	--	--	40	--

[1]400 cfs discharge from pump station coincides with peak flows in Green River.
[2]Decrease in discharges due to P-1 pumping plant pumping 300 cfs into Green River during flood stages.

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Big Soos Creek					
At USGS gage 12-112600	66.7	1,130	1,440	1,550	1,790
Below Covington Creek confluence	49.4	870	1,110	1,190	1,380
Above Covington Creek cofnluence	31.2	580	740	800	920
Above Jenkins Creek confluence	13.5	270	350	390	450
Above Little Soos Creek confluence	9.3	200	250	280	320
At S.E. 244th Street	7.1	150	200	220	260
At S.E. 208th Street	4.5	100	130	150	170
White River					
At Pacific and Auburn	440.0	15,870	17,600	18,370	20,700
Sammamish River					
At mouth	240.0	2,300	3,300	4,300	5,600
At Redmond (downstream of Bear Creek)	144.0	1,740	2,480	2,830	3,820
Swamp Creek					
At USGS gage 12-127100	23.1	600	810	910	1,160
At tributary confluence downstream of 73rd Avenue N.E.	21.9	570	770	870	1,110
At N.E. 205th Street	20.9	550	740	830	1,060
North Creek					
Near Bothell (USGS gage No. 12-1260)	24.6	454	581	634	757
Little Bear Creek					
Above Sammamish River confluence	15.6	320[1]	450[1]	500[1]	570[1]
Above SR-202	15.5	340	490	570	750
At Highway 522	14.7	330	480	550	740
At N.E. 205th Street	13.6	310	450	520	700

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Bear Creek					
At State Route 202	49.8	1,060	1,365	1,535	2,000
Above Evans Creek confluence	33.6	774	996	1,121	1,460
At River Mile 2.4	32.2	742	956	1,075	1,400
At N.E. 95th Street	30.1	710	915	1,028	1,340
At River Mile 3.5	29.3	689	887	998	1,300
Above Cottage Lake Creek confluence	14.7	320	460	520	690
Above Seidal Creek confluence	11.6	260	380	430	570
15 feet downstream of N.E. 145th Street	11.2	250	360	410	550
Above Struve Creek confluence	8.7	200	290	330	450
Above tributary confluence 3,200 feet upstream of N.E. 148th Street	8.0	190	270	310	410
1,500 feet downstream of Woodinville-Duvall Road	7.4	180	250	290	390
At Woodinville-Duvall Road	5.8	140	200	230	310
Evans Creek					
Above Bear Creek confluence (including Bear Creek split-flow return)	--[1]	314	476	581	905
At River Mile 0.4	15.3	280	360	400	496
Near Redmond, at R.M.O. 8	13.0	280	360	400	496
Issaquah Creek					
At Mouth	55.6	2,890	3,700	3,960	4,490
City Limit to Gage at 12121600	54.3	2,890	3,400	3,560	3,940
Through Gilman Bridge	49.4	2,570	3,320	3,550	4,000
Upstream of Gilman Overflow	49.3	2,570	3,690	4,160	5,250
Downstream of East Fork	49.2	2,560	3,670	4,140	5,230
Upstream of East Fork	39.7	2,080	2,980	3,360	4,230

[1]Data Not Available

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
North Fork Issaquah Creek					
At Mouth	4.8	176	269	315	445
At Mouth (including overtopping from Issaquah Creek)	4.8	176	489	835	1,995
East Fork Issaquah Creek					
At Mouth	9.5	560	900	1,050	1,980
Gilman Boulevard Overflow					
At divergence from Issquah Creek	N/A	0.0	370	610	1,250
West Fork Issaquah Creek					
Above Issaquah Creek confluence	4.9	290	460	550	790
2900 feet upstream of 229th Drive S.E.	4.7	270	440	530	770
Above tributary confluence near 208th Avenue S.E.	1.5	100	160	200	280
Gardiner Creek at Northwest 8th Street	1.3	150	--[1]	300	--[1]
Holder Creek					
Above confluence with Carey Creek	7.5	420	660	800	1,150
Tibbetts Creek					
At mouth	3.9	220	355	425	600
May Creek					
At USGS gage 12-119600	12.7	480	800	870	1,020
At Coal Creek Parkway	8.9	350	580	640	750
At 146th Avenue S.E.	7.7	310	520	560	660
At 148th Avenue S.E.	6.9	280	470	510	600
At 146th Avenue S.E.	4.8	200	340	370	440
At S.E. Renton-Issaquah Road	2.9	130	220	240	280
At S.E. May Valley Road	1.2	59	100	110	130
At S.E. 109th Place	0.9	46	78	87	100
May Creek Tributary					
Above confluence with May Creek	1.5	72	120	140	160
Vasa Creek					
At Mouth	1.37	55	81	93	123
At cross section R	0.53	24	38	44	60

[1]Data Not Available

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Cedar River					
At USGS gage 12-119000	186.0	5,460	7,580	8,530	10,900
Mercer Creek (Including both main and right channel)					
At mouth	17.79	490	628	686	819
At confluence with Kelsey and Richards Creeks	13.75	393	510	560	675
Richards Creek					
At mouth	3.63	122	170	191	241
At Interstate Highway 90	1.11	44	65	75	99
At S.E. Newport Way	0.80	33	50	58	78
Richards Creek West Tributary					
At mouth	0.91	37	55	64	85
Richards Creek East Tributary					
Approximately 325 feet upstream of S.E. 26th Street[1]	0.06	4	36	47	81
Kelsey Creek					
At mouth	10.10	301	398	439	536
At 140th Avenue N.E.	6.69	211	285	317	393
At Lake Hills Boulevard	2.25	84	121	138	179
West Tributary Kelsey Creek					
At mouth	1.75	64	92	104	135
At upstream confluence of East Branch	0.34	16	25	29	41
East Branch of West Tributary (Kelsey Creek)					
At mouth	0.92	37	56	64	86

[1]Includes overflow from Richards Creek for 50-, 100-, and 500-year discharges

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
North Branch Mercer Creek (North Valley Creek)					
At mouth	3.10	111	157	177	227
N.E. 40th Street	1.12	46	69	79	106
Thornton Creek					
Above mouth at Lake Washington	12.1	190	290	390	670
At N.E. 93rd Street	11.7	150	230	330	590
At 45th Avenue N.E.	11.5	140	210	310	560
At N.E. 105th Street	11.1	110	170	260	490
At diversion weir to downstream channel	11.0	100	160	250	480
At diversion to Lake Washington	--	210	330	340	350
Below confluence of North and South Fork Thornton Creeks	10.9	310	490	590	830
North Fork Thornton Creek					
Above South Fork Thornton Creek confluence	7.2	160	270	320	470
Below tributary confluence downstream of N.E. 115th Street	6.8	140	230	280	410
At N.E. 115th Street and 35th Avenue N.E.	5.6	90	150	180	270
At N.E. 125th Street	5.2	67	120	150	240
At 15th Avenue N.E.	4.2	42	82	110	170
At Interstate Highway 5	3.7	32	65	84	140
South Fork Thorton Creek					
At 35th Avenue N.E. and N.E. 105th Street	3.8	150	230	270	380
At 30th Avenue N.E.	3.6	140	210	250	350
At Lake City Way	3.2	120	180	210	300
At N.E. 107th Street	2.1	72	110	130	180
At N.E. 105th Street and 8th Avenue N.E.	1.4	50	75	89	120

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
McAleer Creek					
At mouth	7.80	215	278	304	364
Coal Creek					
At mouth	7.31	228	306	340	420
At Interstate Highway 405	6.76	213	287	320	396
Coal Creek Tributary (Newport Creek)					
At mouth	0.31	14	21	25	35
Forbes Creek					
At mouth	3.7	150	180	220	260
Lyon Creek					
At mouth	3.67	147	177	188	214
Yarrow Creek					
At mouth	2.2	--	--	126	--
At unnamed drainageway in Central Business District	1.5	--	--	339	--
At N.E. 40th Street	0.73	29	44	41	68
Meydenbauer Creek					
At mouth	1.26	44	63	72	93
At S.E. 6th Street	0.19	9	14	16	22
North Fork Meydenbauer Creek					
At 102nd Avenue S.E.	0.93	34	49	56	74
South Fork Skykomish River					
At Index gage	355.0	44,300	65,200	74,700	98,500
At Baring	336.0	42,300	62,200	71,300	94,000
Just upstream of Miller Creek	245.0	32,200	47,400	54,300	71,600
Just upstream of Beckler River	139.0	12,600	19,400	22,800	31,700
Maloney Creek					
At Skykomish	3.8	750	980	1,130	1,380

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Miller Creek					
At mouth	8.1	383	575	670	1,050
At sewage treatment plant	--[1]	278	415	479	785
At confluence with Lake Burien Tributary	--[1]	239	364	429	--[1]
Below 1st Avenue	--[1]	159	245	293	475
Below State Highway 509	--[1]	151	235	275	450
At confluence with Lake Lora Tributary	--[1]	109	176	211	--[1]
At Lake Reba outflow	--[1]	90	150	177	310
Walker Creek					
Above confluence with Miller Creek	1.5	281	400	461	605
Tolt River					
At mouth	97	13,900	19,500	22,000	27,800
At USGS Gage 12148500 (near Carnation)	81.4	11,900	16,700	18,800	23,800
Des Moines Creek					
Below Marine View Drive South	5.8	400	600	702	945
Longfellow Creek					
At S.W. Brandon Street	2.7	170	310	380	520
At 26th Street S.W.	2.5	160	290	350	480
At S.W. Juneau Street	2.2	140	250	310	420
At 25th Avenue S.W.	2.1	130	240	290	400
At S.W. Willow Street	2.0	120	230	280	380
At S.W. Myrtle Street	1.4	84	150	180	250
At S.W. Webster Street (Detention basin outflow)	1.2	76	130	150	220
At S.W. Holden Street	1.1	74	120	140	200

[1] Data not available

TABLE 1 - SUMMARY OF DISCHARGES (Cont'd)

Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Rolling Hills Creek					
At Highway 405 culvert entrance near Highway 167	1.2	72[1]	86[1]	91[1]	--[2]
Below east storm drain confluence 600 feet upstream of Highway 405	1.2	77	110	130	--[2]
Unnamed Drainageway					
In the central business district in the City of Kirkland	1.5	--[2]	--[2]	339	--[2]
North Creek					
At mouth	30	958	1,290	1,440	1,810

[1]Downstream decrease in discharge results from routing effects of hydraulic structures
[2]Data not available

McAleer Creek passes through 10 significant hydraulic structures, one private culvert, and numerous private bridges. Lyon Creek passes through 12 significant hydraulic structures. Each of these structures was rated for hydraulic capacity by applying standard hydraulic calculations and hydraulic nomographs (References 53, 54, 55, and 56).

The water-surface elevations for a portion of the upper Green River Valley were computed using the COE G3722110 Water-Surface Profiles computer program (Reference 57).

The water-surface elevations of floods of the selected recurrence intervals on the remaining streams studied by detailed methods were computed using the COE HEC-2 step-backwater computer program (Reference 58).

The starting water-surface elevations for the Snoqualmie River and North, South, and Middle Forks Snoqualmie River, Sammamish River, Tibbetts Creek, and Green River were developed using the slope-area method or were developed from hydraulic rating data. For the most downstream portion of the Green River, the starting water-surface elevation was based on previous studies. The starting water-surface elevation of 6.6 feet, which lies below the highest estimated tide and above the mean high water elevation, was calculated by the COE with the coordination of FEMA Region X.

Starting water-surface elevations for Raging, Cedar, and South Fork Skykomish Rivers, and Big Soos, Swamp, Issaquah, West Fork Issaquah, Thornton, Longfellow, Forbes, Yarrow and Maloney Creeks were determined using normal depth from slope-area methods.

Starting water-surface elevations for Rolling Hills Creek and May Creek were determined to be critical depth. Starting water-surface elevations for May Creek Tributary were the corresponding recurrence interval event water-surface elevations in the main stem at the point of confluence with the tributary.

The starting water-surface elevations for Bear and Evans Creeks are coincident with the elevations at the confluences of the Sammamish River and Bear Creek, respectively.

Starting water-surface elevations for the White River were taken from the COE computer printout and flood profile prepared in 1974 (Reference 40).

The starting water-surface elevation for Lyon Creek and McAleer Creek was the maximum control elevation of Lake Washington, which is 15 feet.

The starting water-surface elevation for North Creek at its mouth was the 10-year flood elevation from the Sammamish River.

Starting water-surface elevations for Little Bear Creek were based on a coincident 25-year recurrence interval Sammamish River flood stage, as was estimated to occur for the January 1986 flooding event. The starting water-surface elevation for Mill Creek (Auburn) was based on computed Green River backwater elevations at the Mill Creek outlet using mean monthly Green River flow data for December and January.

The starting water-surface elevation on Mill Creek (Kent) was obtained from the Springbrook Creek flood profile.

Starting water-surface elevations for the flood profiles for Miller Creek and Walker Creek were taken from the hydraulic study of Puget Sound. Starting elevations for the flood profiles for Des Moines Creek were taken using the 10-year elevation computed for Puget Sound.

For the coastal area studied by detailed methods, the effects of high tidal levels and wave runup were combined to determine the maximum flood elevations above the NGVD of 1929 datum. Wave prediction and wave runup calculations were performed by methods prescribed in the COE Shore Protection Manual (Reference 59).

Starting water-surface elevations for Mercer, Right Channel Mercer, Meydenbauer, North Fork Meydenbauer, Coal, Vasa, Richards, East Tributary Richards, West Tributary Richards, Kelsey, West Tributary Kelsey, East Branch of West Tributary Kelsey, and North Branch Mercer Creeks were computed from:

1. Frequency analysis of lake elevations
2. Profile conveyance of downstream cross sections
3. Culvert ratings where an approach section was the section farthest downstream

The starting water-surface elevations for the Black River, North and East Forks Issaquah Creek, and North and South Forks Thornton Creek are coincident with the elevations at the confluences of the Green River, Issaquah Creek, and Thornton Creek, respectively.

For the Green River, analyses were performed in accordance with FEMA's levee policy. In accordance with those guidelines, two backwater profiles were computed for the reach under study, one for flows confined to the levee system, and a second for the condition of complete levee systems assumed removed for analysis, where levee system freeboard is less than minimum FEMA standards. The general freeboard standard of 3.0 feet for consideration of levee flood protection was lowered by FEMA for the Green River to 2.0 feet based on COE review and recommendations, at the request of King County (Reference 60). Based on the computed with levees water-surface profiles and surveyed cross section and levee profile data, a total of approximately 5.7 river miles of levees were identified as having less than 2.0 feet of freeboard at some locations along a particular levee system.

On Little Bear Creek, high water marks for the January 1986 event were used to calculate flows through culverts and to reduce flows at overbank breakout points, from upstream of the SR 202 culvert, downstream to the Sammamish River confluence. The HEC-2 step-backwater model was calibrated to these conditions. A range of flows were input to the model to develop rating curves for the structures and overflow weirs. The recurrence flows, derived from the hydrologic analyses, were modified to reflect the overflow conditions from review of the rating curves. Sheetflow and ponding caused by the channel overflow was approximated from photographs, topographic maps, high water marks, and local accounts of flooding extent and depths.

The maximum water-surface elevation of the P1 storage pond in Renton was determined by routing the hydrograph through the storage pond and pumping station by using the storage-elevation relationship for the pond and the pumping station's firm capacity of 875 cfs as the maximum discharge. The 10-year water-surface profile for Springbrook Creek was started at normal depth because normal depth was greater than 3.5 feet NGVD, which is the maximum water-surface elevation of the P1 storage pond under standard operating procedures. The peak 10-year flow into the storage pond is less than the maximum pumping rate and, therefore, no rise in the water-surface elevation of the storage pond should occur during the 10 year event. Two conditions were considered for each of the 50- and 100-year events. The first consisted of modeling the effects on the Springbrook Creek study reach of the computed maximum water-surface elevation that may be reached in the storage pond (the starting water-surface elevation) coincident with the flow that would be discharged from Springbrook Creek at that time step in the inflow runoff hydrograph. The second condition of analysis consisted of modeling the effects of Springbrook Creek peak inflows for the recurrence interval event under consideration, with a starting water-surface elevation of the higher of normal depth, or the coincident elevation of the storage pond at the time of the peak inflow. For each recurrence interval, the higher water-surface elevation resulting from each of those analysis conditions at the study reach cross sections was used for final flood profile determination.

The COE regulates the water level of Lake Washington at the Hiram M. Chittenden Locks on the Lake Washington Ship Canal. The lake level is drawn down during the winter months and is typically regulated at elevation 13.2 NGVD for that period.

In the summer months, the lake level is raised to an elevation of 15.0 feet NGVD. That elevation exceeds the normal depth water-surface elevation determined at the mouth of the Cedar River for the 10-, 50-, and 100-year recurrence interval flows. Therefore, the flood profiles for the Cedar River includes the backwater impact from Lake Washington until the profile that was started at normal depth exceeds the 15.0-foot elevation for the 100-year recurrence interval event at the first cross section, with lake backwater shown for the lesser recurrence intervals.

For the coastal areas studied by detailed methods near Des Moines and Normandy Park, the effects of high tidal levels and wave runup were combined to determine the maximum flood elevations. Wave prediction and wave runup calculations were performed by methods prescribed in the COE Shore Protection Manual (Reference 59) and wave runup elevations for the 10-, 50-, 100-, and 500-year conditions for Puget Sound north of and outside the breakwater of Des Moines Marina, and the 100-year condition for unprotected areas south of Des Moines Marina are shown in Table 2, "Summary of Elevations."

Table 2 - Summary of Elevations

Flooding Source and Location	Elevation in Feet (NGVD) 10-Year	50-Year	100-Year	500-Year
Puget Sound				
Area from northwest corporate limits of Normandy Park to confluence with Miller Creek	10.2	13.5	16.3	16.7
Area from confluence with Miller Creek to vicinity of Shorebrook Drive	8.3	8.9	9.1	9.5
Area from vicinity of Shorebrook Drive to vicinity of SW Shoremont Avenue	10.2	13.5	16.3	16.7
Area from vicinity of SW Shoremont Avenue to just south of Normandy Park Creek	8.6	9.6	10.1	10.5
Area from just south of Normandy Park Creek to vicinity of SW 201st Street extended	10.2	13.5	16.3	16.7
Area from vicinity of SW 201st Street extended to vicinity of SW 202nd Street extended	8.3	8.9	9.1	9.5
Area from vicinity of SW 202nd Street extended to vicinity of SW 203rd Street extended	8.6	9.6	10.1	10.5
Area from vicinity of SW 203rd Street extended to vicinity of SW 207th Street extended	10.2	13.5	16.3	16.7

Table 2 - Summary of Elevations (Cont'd)

Flooding Source and Location	Elevation in Feet (NGVD) 10-Year	50-Year	100-Year	500-Year
Area in the vicinity of SW 207th Street extended	8.6	9.6	10.1	10.5
Area from vicinity of SW 207th Place extended to Normandy Park-Des Moines corporate limits	10.2	13.5	16.3	16.7
Unprotected Area North of Des Moines Marina and Area Outside the Breakwater	10.2	13.5	16.3	16.7
Protected Area Within the Breakwater and Area Shadowed by the Breakwater	8.3	8.9	9.1	9.5
Unprotected Area South of Des Moines Marina	8.3	8.9	9.1/12.7[1]	9.5
Lake Sammamish	29.0	31.3	32.5	34.0

[1]Stillwater Elevation/Wave Runup Elevation

Areas of coastline subject to wave attack are referred to as coastal high hazard zones. Factors considered in determining wave runup included length of fetch, sustained wind velocities, coastal water depths, land slopes, and other physical features of the coastline that could appreciably affect wave propagation. Much of the coastline along Des Moines is protected by a breakwater that extends north and south along the coast to protect the Des Moines Marina. The area west of this breakwater and the unprotected area north and south of the breakwater have been designated coastal high hazard zones. The unprotected sections of the coastline are subject to wave attack generated by high winds from a southwest direction across Puget Sound. The remaining coastal areas inland from the breaking waves, subject only to wave runup, and areas sheltered by the breakwater are not exposed to severe wave attack and have not been designated as part of a coastal high hazard zone.

Elevations on Lake Sammamish for the various frequency floods are controlled by the COE Lake Sammamish outlet project built in 1966. This project consists of a low weir designed to maintain the lake elevation at 29.0 feet for the 10-year flood. The elevations for the 50-, 100-, and 500-year floods were computed by routing techniques through the lake. Elevations for floods for the selected recurrence intervals are also presented in Table 2.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the stream and floodplain areas, and hydraulic calibration of flood profiles to available high water mark data. The range of channel and overbank "n" values for the various flooding sources are listed in Table 3.

Flood profiles were computed an accuracy of approximately 1.0 foot for floods of the selected recurrence intervals and are shown in Exhibit 1. The degree of accuracy of the water-surface profiles is limited to 1.0 foot by the location and accuracy of the cross sections, the extent of the various energy losses of the system, and the general limitations of backwater calculations. The accuracy of 1.0 foot is consistent with the accuracy of predicted peak discharges and the knowledge that unpredictable events during actual floods will likely cause deviations from the predicted profile.

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 (see Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Maps (Exhibit 2).

For streams studied by approximate methods, the 100-year floodplains were approximated by field inspections and observations and by normal depth calculation using estimated 100-year recurrence interval floodflows and approximate cross sections taken from field investigations or from topographic maps, where available. Computed depth from minimum channel elevation and average floodflow velocity are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operated properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation Reference Marks (ERMs) and their descriptions are shown on the maps. ERMs shown on the FIRM represent those used during the preparation of this and previous Flood Insurance Studies. The elevations associated with each ERM were obtained and/or developed during FIS production to establish vertical control for determination of flood elevations and floodplain boundaries shown on the FIRM. Users should be aware that these ERM elevations may have changed since the publication of this FIS. To obtain up-to-date elevation information on National Geodetic Survey (NGS) ERMs 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. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

Table 3. Manning's "n" Values

Stream	Channel "n" Range	Overbank "n" Range
Snoqualmie River (Mainstem and Middle and North Forks)	0.028-0.058	0.040-0.170
Raging River	0.035-0.080	0.050-0.090
Green River	0.020-0.055	0.060-0.300
Black River/Springbrook Creek	0.011-0.050	0.050-0.150
Mill Creek (Auburn)	0.012-0.090	0.045-0.095
Mill Creek (Kent)	0.012-0.041	0.050-0.120
Big Soos Creek	0.024-0.090	0.040-0.150
White River	0.027-0.057	0.040-0.085
Sammamish River	0.026-0.057	0.040-0.140
Swamp Creek	0.045-0.085	0.050-0.120
North Creek	0.030-0.055	0.050-0.100
Little Bear Creek	0.012-0.080	0.016-0.150
Bear Creek	0.040-0.100	0.060-0.300
Evans Creek	0.039-0.063	0.056-0.135
Issaquah Creek	0.030-0.088	0.035-0.300
North Fork Issaquah Creek	0.026-0.055	0.070-0.120
West Fork Issaquah Creek	0.024-0.050	0.035-0.120
East Fork Issquah Creek	0.035-0.060	0.050-0.250
Gilman Boulevard Overflow	0.040-0.045	0.030-0.045
Holder Creek	0.030-0.055	0.020-0.120
Tibbetts Creek	0.027-0.055	0.080-0.130
May Creek	0.030-0.090	0.055-0.150
May Creek Tributary	0.040	0.070
Vasa Creek	0.035-0.042	0.055-0.075
Cedar River	0.020-0.055	0.033-0.150
Mercer Creek	0.035-0.042	0.055-0.075
Right Channel Mercer Creek	0.035-0.042	0.055-0.075
Richards Creek	0.035-0.042	0.055-0.075
Richards Creek West Tributary	0.035-0.042	0.055-0.075
Richards Creek East Tributary	0.035-0.042	0.055-0.075
Kelsey Creek	0.035-0.042	0.055-0.075
West Tributary Kelsey Creek	0.035-0.042	0.055-0.075
East Branch of West Tributary Kelsey Creek	0.035-0.042	0.055-0.075
North Branch Mercer Creek	0.035-0.042	0.055-0.075
Thornton Creek	0.012-0.045	0.028-0.120
North Fork Thornton Creek	0.012-0.045	0.028-0.120

Table 3. Manning's "n" Values (Cont'd)

Stream	Channel "n" Range	Overbank "n" Range
South Fork Thornton Creek	0.012-0.045	0.028-0.120
McAleer Creek	0.025-0.050	0.013-0.080
Coal Creek	0.035-0.042	0.055-0.075
Forbes Creek	0.045	0.050
Lyon Creek	0.025	0.050
Yarrow Creek	0.045	0.150
Meydenbauer Creek	0.035-0.042	0.055-0.075
North Fork Meydenbauer Creek	0.035-0.042	0.055-0.075
Tolt River	0.042-0.055	0.070-0.100
South Fork Skykomish River	0.038-0.048	0.080-0.120
Maloney Creek	0.037-0.055	0.050-0.100
Miller Creek	0.040-0.050	0.060-0.120
Walker Creek	0.050	0.060-0.120
Des Moines Creek	0.030-0.040	0.050-0.100
Longfellow Creek	0.025-0.065	0.065-0.070
Rolling Hills Creek	0.025-0.040	0.020-0.060
South Fork Snoqualmie River	0.038-0.100	0.070-0.120
Middle Fork Snoqualmie River Overflow Channels	0.040-0.045	0.075
Gardiner Creek	0.070-0.080	0.070-0.200
Ribary Creek	0.045-0.048	0.050-0.120

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities and counties in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated. using topographic maps at scales of 1:240, 1:1,200, 1:2,400, 1:4,800, and 1:6,000, with contour intervals of 1, 2, 4, 5, and 10 feet (References 46 and 63 to 78).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO and VE); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year 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 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from Flood Hazard Boundary Maps (References 79 to 89), or Flood Insurance Rate Maps (References 90 and 91).

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. 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 100-year 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 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodways widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 4). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown Figure 2.

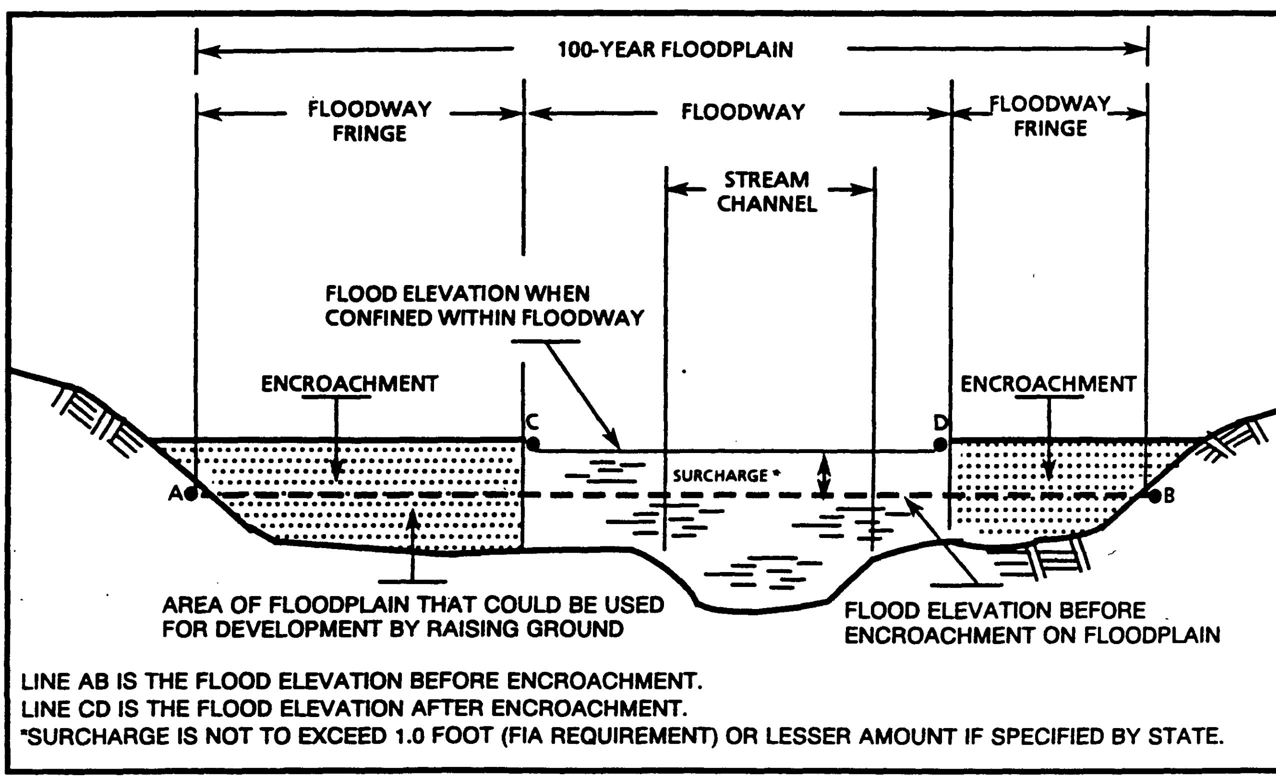


Figure 2. Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Bear Creek								
A	0.06[1]	258	744	2.1	31.7	31.3[3]	32.2[3]	1.0
B	0.47[1]	757	1,387	1.1	36.2	36.2	36.3	0.1
C	0.67[1]	309	1,108	1.4	38.2	38.2	38.5	0.3
D	0.78[1]	232	953	1.6	38.7	38.7	39.1	0.4
E	0.86[1]	255	1,359	1.1	38.8	38.8	39.3	0.5
F	0.00[2]	71	446	3.4	41.5	41.5	42.5	1.0/0.0[4]
G	1,455[2]	154	659	2.3	43.3	43.3	43.8	1.0/0.0[4]
H	2,523[2]	160	895	1.7	46.1	46.1	46.7	1.0/0.0[4]
I	3,563[2]	590	2,311	0.7	46.3	46.3	47.0	0.9/0.1[4]
J	4,655[2]	747	2,090	0.7	46.4	46.4	47.2	1.0/0.0[4]
K	6,764[2]	415	709	1.6	47.9	47.9	48.8	0.9/0.1[4]
L	7,664[2]	33	159	6.7	49.0	49.0	50.0	1.0/0.0[4]
M	8,525[2]	100	530	2.0	53.3	53.3	54.3	1.0/0.0[4]
N	10,232[2]	35	262	4.1	56.7	56.7	57.5	0.8/0.2[4]
O	11,575[2]	200	703	1.5	58.4	58.4	59.4	1.0/0.0[4]
P	13,713[2]	118	691	1.4	62.6	62.6	63.6	0.9/0.1[4]
Q	16,016[2]	125	596	1.7	67.1	67.1	67.8	0.7/0.3[4]
R	19,048[2]	91	423	2.4	74.1	74.1	75.1	1.0/0.0[4]
S	20,277[2]	66	297	3.4	80.1	80.1	80.2	0.1/0.9[4]
T	21,325[2]	80	414	2.4	81.7	81.7	82.4	0.7/0.3[4]
U	21,980[2]	55	341	2.9	82.9	82.9	83.7	0.8/0.2[4]
V	23,059[2]	45	278	3.6	86.0	86.0	86.6	0.7/0.3[4]
W	23,930[2]	100	486	2.1	88.0	88.0	88.2	0.3/0.7[4]
X	25,253[2]	85	236	2.2	91.3	91.3	91.8	0.6/0.4[4]
Y	5.54[1]	34	179	2.9	94.2	94.2	95.0	0.8

[1]Miles Above Mouth [2]Feet Above State Route 202 [3]Elevation Computed Without Consideration of Backwater Effects From Sammamish River [4]Surcharge Over Base Conditions/Available Surcharge

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Bear Creek (Cont'd)								
Z	5.67	41	176	3.0	97.2	97.2	97.9	0.7
AA	5.81	38	189	2.8	100.3	100.3	100.8	0.5
AB	5.94	48	144	3.5	102.8	102.8	103.1	0.3
AC	5.98	44	128	3.9	104.0	104.0	104.1	0.1
AD	6.02	81	270	1.9	105.1	105.1	105.2	0.1
AE	6.21	96	230	2.2	110.2	110.2	110.8	0.6
AF	6.41	69	255	2.0	118.4	118.4	118.9	0.5
AG	6.45	20	122	4.1	119.0	119.0	119.5	0.5
AH	6.45	20	102	4.9	119.0	119.0	119.6	0.6
AI	6.49	79	313	1.6	120.2	120.2	120.6	0.4
AJ	6.63	84	235	1.8	122.0	122.0	122.6	0.6
AK	6.75	76	189	2.3	124.7	124.7	125.2	0.5
AL	6.90	30	129	3.3	127.3	127.3	128.1	0.8
AM	6.97	71	197	2.2	128.7	128.7	129.7	1.0
AN	7.03	83	283	1.5	129.6	129.6	130.6	1.0
AO	7.20	81	244	1.8	133.2	133.2	134.2	1.0
AP	7.23	31	122	3.5	133.8	133.8	134.7	0.9
AQ	7.23	31	139	3.1	134.1	134.1	135.0	0.9
AR	7.29	49	143	3.0	135.8	135.8	136.4	0.6
AS	7.37	29	107	4.0	138.4	138.4	138.7	0.3
AT	7.42	47	212	2.0	139.4	139.4	139.9	0.5
AU	7.60	23	56	7.3	142.8	142.8	143.1	0.3
AV	7.67	34	105	3.9	146.9	146.9	147.7	0.8
AW	7.76	42	140	2.9	150.2	150.2	150.5	0.3
AX	7.84	33	121	3.4	152.3	152.3	152.3	0.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Bear Creek (Cont'd)								
AY	7.88	9	36	11.4	154.9	154.9	154.9	0.0
AZ	7.94	27	140	2.4	158.8	158.8	159.3	0.5
BA	8.10	39	92	3.6	161.5	161.5	162.4	0.9
BB	8.16	19	76	4.4	164.8	164.8	164.9	0.1
BC	8.16	19	85	3.9	165.2	165.2	165.3	0.1
BD	8.21	46	149	2.2	166.3	166.3	166.5	0.2
BE	8.34	29	74	4.5	170.8	170.8	171.3	0.5
BF	8.54	44	130	2.5	180.3	180.3	180.4	0.1
BG	8.70	84	262	1.3	183.0	183.0	183.5	0.5
BH	8.87	86	177	1.7	185.6	185.6	186.6	1.0
BI	8.97	56	69	4.5	194.4	194.4	194.6	0.2
BJ	9.04	23	94	3.3	201.0	201.0	201.0	0.0
BK	9.08	43	76	4.1	202.8	202.8	202.9	0.1
BL	9.18	23	73	4.2	211.8	211.8	211.8	0.0
BM	9.31	87	166	1.9	218.6	218.6	218.7	0.1
BN	9.40	95	168	1.8	222.0	222.0	222.0	0.0
BO	9.55	114	142	2.2	229.3	229.3	229.3	0.0
BP	9.61	34	99	3.1	232.0	232.0	232.0	0.0
BQ	9.65	38	124	2.5	233.1	233.1	233.2	0.1
BR	9.76	36	101	2.9	236.3	236.3	236.8	0.5
BS	9.85	44	130	2.2	239.5	239.5	239.7	0.2
BT	9.98	64	234	1.2	240.5	240.5	241.0	0.5
BU	10.09	54	199	1.5	241.2	241.2	242.0	0.8
BV	10.13	20	83	2.8	241.7	241.7	242.5	0.8
BW	10.14	20	79	2.9	242.0	242.0	242.7	0.7

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Bear Creek (Cont'd)								
BX	10.17	34	111	2.1	242.8	242.8	243.4	0.6
BY	10.23	31	118	1.9	245.0	245.0	245.5	0.5
BZ	10.32	30	103	2.2	246.4	246.4	247.1	0.7
CA	10.49	51	127	1.8	251.5	251.5	251.9	0.4
CB	10.64	47	132	1.7	255.2	255.2	255.5	0.3
CC	10.69	44	162	1.4	255.8	255.8	256.3	0.5
CD	11.02	45	188	1.2	258.2	258.2	259.1	0.9

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Big Soos Creek								
A	17,687	20	76	10.5	171.3	171.3	171.4	0.1
B	17,849	20	201	4.0	174.4	174.4	174.4	0.0
C	17,949	63	276	2.9	174.6	174.6	174.6	0.0
D	18,909	72	194	4.1	182.8	182.8	182.8	0.0
E	20,189	33	180	4.4	199.2	199.2	200.0	0.8
F	20,989	52	170	4.7	210.1	210.1	211.1	1.0
G	21,939	51	295	2.7	216.7	216.7	217.7	1.0
H	23,099	32	85	9.4	232.7	232.7	232.7	0.0
I	25,019	46	244	3.3	258.6	258.6	259.6	1.0
J	25,969	27	113	7.1	268.5	268.5	269.2	0.7
K	26,609	32	124	3.1	281.5	281.5	281.5	0.0
L	27,769	37	77	5.0	296.3	296.3	296.4	0.1
M	29,169	41	220	1.8	303.4	303.4	304.4	1.0
N	29,369	33	168	2.3	303.9	303.9	304.9	1.0
O	29,515	48	246	1.6	304.4	304.4	305.2	0.8
P	30,315	49	196	2.0	305.7	305.7	306.6	0.9
Q	31,515	43	143	2.7	309.6	309.6	310.6	1.0
R	32,635	165	620	0.6	310.8	310.8	311.8	1.0
S	33,124	32	151	2.6	313.1	313.1	313.8	0.7
T	33,224	185	722	0.5	313.1	313.1	314.0	0.9
U	33,904	44	95	3.0	313.3	313.3	314.3	1.0
V	34,704	48	176	1.6	316.1	316.1	316.5	0.4
W	34,954	66	289	1.0	316.3	316.3	316.7	0.4
X	35,113	40	176	1.6	316.4	316.4	316.8	0.4
Y	36,313	59	286	1.0	316.6	316.6	317.6	1.0
Z	38,163	190	365	0.8	317.5	317.5	318.4	0.9

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BIG SOOS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Big Soos Creek (Cont'd)								
AA	39,843	217	264	1.1	319.9	319.9	320.1	0.2
AB	41,903	96	248	1.1	323.7	323.7	324.7	1.0
AC	42,248	34	210	1.3	326.6	326.6	326.8	0.2
AD	42,448	63	240	1.2	326.7	326.7	327.2	0.5
AE	43,209	25	120	2.3	326.9	326.9	327.7	0.8
AF	43,329	134	510	0.5	327.1	327.1	327.8	0.7
AG	44,689	34	126	2.2	327.3	327.3	328.3	1.0
AH	46,529	21	96	2.9	331.0	331.0	332.0	1.0
AI	46,677	19	99	2.8	331.2	331.2	332.2	1.0
AJ	46,837	27	129	1.7	331.7	331.7	332.6	0.9
AK	47,737	24	100	2.2	332.6	332.6	333.5	0.9
AL	48,280	23	72	3.1	333.9	333.9	334.3	0.4
AM	48,290	45	73	3.0	334.0	334.4	334.4	0.4
AN	50,070	59	118	1.9	335.5	335.5	336.5	1.0
AO	52,270	21	58	3.8	340.6	340.6	340.6	0.0
AP	52,470	50	160	1.4	342.2	342.2	342.2	1.0
AQ	53,670	56	201	1.1	343.0	343.0	344.0	1.0
AR	55,010	143	335	0.7	344.1	344.1	345.0	0.9
AS	55,156	13	62	3.6	344.6	344.6	345.6	1.0
AT	55,216	94	290	0.8	345.2	345.2	346.0	0.8
AU	56,896	20	47	4.7	346.9	346.9	347.5	0.6
AV	57,636	101	232	0.9	348.1	348.1	349.0	0.9
AW	57,886	14	50	4.4	348.3	348.3	349.2	0.9
AX	58,015	68	159	1.4	349.3	349.3	350.0	0.7

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BIG SOOS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Big Soos Creek (Cont'd)								
AY	59,215	13	42	5.2	351.0	351.0	351.8	0.8
AZ	60,495	76	127	1.7	354.9	354.9	355.7	0.8
BA	60,775	15	46	4.7	355.7	355.7	356.5	0.8
BB	61,025	49	101	1.5	357.0	357.0	357.2	0.2
BC	61,925	27	31	4.8	358.7	358.7	358.7	0.0
BD	62,323	13	46	3.3	360.6	360.6	361.4	0.8
BE	62,473	139	361	0.4	361.0	361.0	361.7	0.7
BF	64,353	44	115	1.3	361.1	361.1	362.1	1.0
BG	65,563	31	42	2.2	364.3	364.3	364.3	0.0
BH	66,623	40	75	1.2	365.8	365.8	366.6	0.8
BI	67,623	46	64	1.4	368.0	368.0	369.0	1.0
BJ	67,792	5	19	4.9	370.0	370.0	370.3	0.3
BK	67,932	11	44	2.0	370.6	370.6	370.9	0.3
BL	68,932	84	201	0.4	370.8	370.8	371.5	0.7
BM	70,132	11	24	3.7	371.4	371.4	372.2	0.8
BN	71,516	74	134	0.7	380.3	380.3	380.3	0.0
BO	72,676	90	234	0.4	380.3	380.3	380.8	0.5
BP	74,054	97	77	1.2	380.7	380.7	381.6	0.9
BQ	75,314	17	16	5.6	396.8	396.8	396.8	0.0

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

BIG SOOS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[2] FLOODWAY (FEET NGVD)	WITH[2] FLOODWAY (FEET NGVD)	INCREASE
Cedar River								
A	0.01	156	916	9.3	15.0	14.6	14.6	0.0
B	0.17	148	856	10.0	16.7	16.7	16.7	0.0
C	0.31	159	1,112	7.7	18.8	18.8	18.8	0.0
D	0.48	141	941	9.1	19.9	19.9	20.0	0.1
E	0.64	131	948	9.0	21.5	21.5	21.6	0.1
F	0.74	167	1,139	7.5	22.8	22.8	22.8	0.0
G	0.78	135	1,247	6.8	24.8	24.8	24.8	0.0
H	0.88	132	1,122	7.6	25.2	25.2	25.2	0.0
I	0.99	133	1,042	8.2	25.7	25.7	25.8	0.1
J	1.07	152	1,098	7.8	26.4	26.4	26.5	0.1
K	1.14	137	1,103	7.7	27.1	27.1	28.0	0.9
L	1.23	135	1,033	8.3	27.9	27.9	28.6	0.7
M	1.27	127	1,061	8.0	28.5	28.5	29.4	0.9
N	1.31	124	1,135	7.5	29.2	29.2	29.9	0.7
O	1.35	141	1,081	7.9	29.4	29.4	30.0	0.6
P	1.42	128	997	8.6	29.8	29.8	30.3	0.5
Q	1.45	129	849	10.0	30.0	30.0	30.5	0.5
R	1.49	136	1,051	8.1	31.3	31.3	31.5	0.2
S	1.53	126	1,046	8.2	31.6	31.6	32.6	1.0
T	1.59	122	1,058	8.1	32.3	32.3	33.0	0.7
U	1.61	105	982	8.7	32.5	32.5	33.5	1.0
V	1.63	161	1,387	6.2	33.6	33.6	34.3	0.7
W	1.67	160	1,337	6.4	34.0	34.0	34.6	0.6
X	1.79	114	1,057	8.1	35.3	35.3	35.7	0.4
Y	1.94	137	1,222	7.0	38.0	38.0	38.1	0.1
Z	2.11	98	1,031	8.3	40.3	40.3	40.4	0.1

[1]Miles Above Mouth
[2]Elevations Computed Without Consideration of Backwater from Lake Washington

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Cedar River (Cont'd)								
AA	2.16	103	1,160	8.5	40.7	40.7	40.7	0.0
AB	2.32	110	1,490	6.6	43.4	43.4	43.4	0.0
AC	2.47	142	1,500	6.5	45.2	45.2	45.2	0.0
AD	2.73	141	1,210	8.1	49.5	49.5	49.5	0.0
AE	2.90	130	1,310	7.5	52.6	52.6	52.6	0.0
AF	2.96	140	1,220	8.1	53.6	53.6	53.6	0.0
AG	3.02	150	1,070	9.1	55.4	55.4	55.4	0.0
AH	3.25	210	1,690	5.8	60.9	60.9	61.0	0.1
AI	3.37	196	1,310	7.5	62.8	62.8	62.9	0.1
AJ	3.58	288	1,685	4.0	67.3	67.3	67.6	0.3
AK	3.84	252	1,535	4.3	70.9	70.9	71.2	0.3
AL	4.03	210	990	9.9	75.0	75.0	75.1	0.1
AM	4.23	169	1,155	6.1	78.8	78.8	78.8	0.0
AN	4.39	349	1,869	3.5	81.6	81.6	81.7	0.1
AO	4.63	400	2,535	3.9	83.7	83.7	83.8	0.1
AP	4.77	279	1,257	5.8	87.2	87.2	87.3	0.1
AQ	4.88	410	1,358	4.5	90.5	90.5	90.7	0.2
AR	5.20	700	1,693	4.1	96.9	96.9	97.0	0.1
AS	5.34	328	1,978	3.4	99.0	99.0	99.3	0.3
AT	5.53	298	1,208	5.1	103.3	103.3	103.6	0.3
AU	5.72	355	1,330	4.7	107.6	107.6	108.5	0.9
AV	5.96	280	2,038	2.9	111.8	111.8	112.7	0.9
AW	6.09	300	2,134	4.6	114.1	114.1	114.5	0.4
AX	6.30	188	1,140	5.8	118.2	118.2	118.3	0.1
AY	6.46	221	1,934	3.2	123.0	123.0	123.2	0.2
AZ	6.63	325	1,489	4.5	126.9	126.9	127.1	0.2

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Cedar River (Cont'd)								
BA	6.83	322	1,375	3.5	130.7	130.7	131.0	0.3
BB	6.98	200	1,325	7.4	134.5	134.5	134.8	0.3
BC	7.12	218	935	6.3	139.1	139.1	139.2	0.1
BD	7.25	240	1,943	3.0	143.7	143.7	143.8	0.1
BE	7.44	500	1,462	4.2	146.1	146.1	146.4	0.3
BF	7.66	290	940	5.2	149.9	149.9	150.1	0.2
BG	7.87	400	921	4.5	155.3	155.3	155.3	0.0
BH	8.07	300	972	5.3	160.8	160.8	161.0	0.2
BI	8.18	280	1,056	6.3	164.0	164.0	164.0	0.0
BJ	8.32	418	1,489	3.1	168.0	168.0	168.3	0.3
BK	8.52	518	1,674	5.1	171.9	171.9	172.5	0.6
BL	8.74	305	902	6.7	177.5	177.5	178.0	0.5
BM	8.97	229	1,746	3.2	183.6	183.6	183.6	0.0
BN	9.20	170	1,089	8.9	186.7	186.7	186.7	0.0
BO	9.39	211	1,440	4.7	191.4	191.4	191.6	0.2
BP	9.52	315	1,155	6.7	193.6	193.6	193.8	0.2
BQ	9.65	280	1,443	4.0	196.4	196.4	196.9	0.5
BR	9.75	195	1,442	3.8	198.4	198.4	198.7	0.3
BS	10.05	310	1,441	4.3	203.3	203.3	203.7	0.4
BT	10.27	400	1,911	4.0	206.8	206.8	207.8	1.0
BU	10.43	350	1,251	5.4	209.7	209.7	210.7	1.0
BV	10.62	800	3,294	2.6	216.7	216.7	216.9	0.2
BW	10.75	600	2,297	4.1	218.0	218.0	218.6	0.6
BX	10.90	500	1,379	4.7	220.8	220.8	221.3	0.5
BY	11.06	314	1,521	3.3	224.4	224.4	224.8	0.4
BZ	11.10	202	1,386	7.3	225.7	225.7	226.0	0.3

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Cedar River (Cont'd)								
CA	11.17	248	1,544	3.2	229.2	229.2	229.2	0.0
CB	11.38	300	1,546	4.3	232.7	232.7	232.8	0.1
CC	11.66	180	1,385	2.9	234.9	234.9	235.1	0.2
CD	11.78	160	878	11.0	237.7	237.7	237.8	0.1
CE	11.97	280	1,602	2.9	245.0	245.0	245.0	0.0
CF	12.13	390	1,741	2.5	247.0	247.0	247.1	0.1
CG	12.34	500	1,593	4.5	250.9	250.9	251.2	0.3
CH	12.52	480	1,490	3.6	256.3	256.3	256.7	0.4
CI	12.59	500	1,108	8.8	258.8	258.8	259.0	0.2
CJ	12.83	210	1,094	5.2	266.0	266.0	266.0	0.0
CK	13.05	520	2,123	2.9	270.9	270.9	271.1	0.2
CL	13.41	600	3,201	2.0	284.4	284.4	284.4	0.0
CM	13.83	800	1,807	3.5	291.0	291.0	291.1	0.1
CN	14.18	500	2,009	3.2	301.3	301.3	301.4	0.1
CO	14.61	150	1,259	4.1	313.6	313.6	313.7	0.1
CP	15.78	320	1,406	4.5	346.9	346.9	347.2	0.3
CQ	15.95	140	951	4.1	351.1	351.1	351.2	0.1
CR	16.46	410	1,302	4.4	363.7	363.7	364.0	0.3
CS	16.62	240	1,082	4.4	368.5	368.5	368.7	0.2
CT	16.73	222	1,525	4.0	372.6	372.6	372.9	0.3
CU	16.89	180	1,294	7.3	376.3	376.3	376.7	0.4
CV	17.05	240	894	6.9	380.9	380.9	381.2	0.3
CW	17.22	360	2,050	2.1	387.1	387.1	387.9	0.8
CX	17.68	250	740	8.3	401.3	401.3	401.7	0.4
CY	17.93	200	1,201	7.9	411.0	411.0	412.0	1.0
CZ	18.90	160	1,026	5.8	447.3	447.3	447.7	0.4

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Cedar River (Cont'd)								
DA	19.10	150	980	9.7	453.4	453.4	453.5	0.1
DB	19.30	180	1,020	9.3	460.2	460.2	460.2	0.0
DC	19.60	200	910	6.1	472.2	472.2	472.4	0.2
DD	20.01	230	1,317	7.2	484.7	484.7	485.0	0.3
DE	20.24	250	851	7.0	491.3	491.3	491.3	0.0
DF	20.24	250	1,005	9.4	499.2	499.2	499.3	0.1
DG	20.81	200	782	12.1	512.2	512.2	512.2	0.0
DH	21.10	200	1,175	8.1	522.8	522.8	522.8	0.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
EAST FORK ISSAQUAH CREEK								
A	100	30	155	6.8	75.0	73.0[2]	73.9[2]	0.9
B	334	23	114	9.2	75.8	75.8	76.7	0.9
C	620	28	123	8.6	80.2	80.2	80.8	0.6
D	871	30	184	5.7	85.5	85.5	86.1	0.6
E	1,071	34	150	7.1	87.6	87.6	87.6	0.0
F	1,164	42	152	6.9	88.4	88.4	88.4	0.0
G	1,540	29	113	9.3	91.6	91.6	92.1	0.5
H	1,950	35	143	7.4	98.3	98.3	98.9	0.6
I	2,069	59	234	4.0	100.4	100.4	101.2	0.8
J	2,166	41	152	7.2	101.2	101.2	101.6	0.4
K	2,657	35	155	6.8	106.5	106.5	107.4	0.9
L	3,053	27	128	8.2	111.2	111.2	111.8	0.6
M	3,543	28	151	7.0	118.5	118.5	119.5	1.0
N	3,950	76	222	4.7	125.1	125.1	125.3	0.2
O	4,415	45	177	5.9	134.1	134.1	134.7	0.6
P	4,696	32	136	7.7	138.3	138.3	138.3	0.0
Q	4,912	21	127	8.2	141.2	141.2	141.8	0.6
R	5,201	31	131	8.0	146.4	146.4	147.0	0.6
S	5,378	22	91	11.5	153.5	153.5	153.5	0.0

[1] Stream distance in feet above confluence with Issaquah Creek

[2] Elevation computed without consideration of backwater effects

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

EAST FORK ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Evans Creek								
A	0.35	39	137	2.9	49.4	49.4	50.3	0.9
B	0.81	190	136	2.1	56.3	56.3	56.8	0.5
C	1.21	90	197	1.7	62.5	62.5	63.3	0.8
D	1.41	294	552	1.1	63.2	63.2	64.0	0.8
E	1.71	189	290	1.2	63.8	63.8	64.7	0.9
F	1.95	300	400	1.1	65.3	65.3	66.3	1.0
G	2.28	125	116	2.6	67.9	67.9	68.4	0.5
H	2.29	128	159	1.4	68.6	68.6	68.9	0.3
I	2.48	144	100	2.4	72.3	72.3	72.5	0.2
J	2.67	120	170	1.4	75.1	75.1	75.4	0.3
K	2.88	150	157	2.1	76.4	76.4	76.8	0.4
L	3.01	208	652	0.6	76.8	76.8	77.4	0.6
M	3.14	170	65	4.7	79.1	79.1	79.1	0.0
N	3.53	159	472	1.0	84.3	84.3	84.3	0.0
O	3.85	200	396	1.2	85.1	85.1	85.4	0.3
P	4.21	220	137	2.2	92.6	92.6	92.6	0.0
Q	4.27	207	90	1.8	95.1	95.1	95.1	0.0
R	4.65	120	56	3.6	101.7	101.7	102.0	0.3

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

EVANS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Forbes Creek								
A	0.27	87	170	1.3	19.8	19.8	20.3	0.5
B	0.31	100	191	1.1	20.5	20.5	21.2	0.7
C	0.49	55	88	2.1	27.6	27.6	28.2	0.6
D	0.63	52	70	2.1	36.2	36.2	36.5	0.3
E	0.73	57	102	1.5	37.8	37.8	38.0	0.2
F	0.86	59	36	4.2	42.4	42.4	42.4	0.0
G	0.92	100	56	2.0	48.1	48.1	48.5	0.4
H	0.93	60	109	1.0	48.2	48.6	48.6	0.4
I	1.05	14	19	5.7	53.4	53.4	53.4	0.0
J	1.15	15	22	5.0	69.4	69.4	69.8	0.4
K	1.18	20	56	2.0	78.5	78.5	78.8	0.3
L	1.22	18	56	2.0	85.5	85.5	85.5	0.0
M	1.34	16	18	6.2	104.4	104.4	104.4	0.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

FORBES CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (Without Levees)								
A	3.90	450	9,977	1.2	8.2	8.2	8.2	0.0
B	4.38	443	8,939	1.3	8.3	8.3	8.3	0.0
C	4.80	500	9,357	1.3	8.3	8.3	8.3	0.0
D	5.21	800	13,904	0.9	8.3	8.3	8.3	0.0
E	5.42	400	4,953	2.4	8.3	8.3	8.3	0.0
F	5.68	260	3,626	3.3	8.5	8.5	8.5	0.0
G	5.98	290	4,571	2.6	8.7	8.7	8.7	0.0
H	6.20	400	4,679	2.6	8.8	8.8	8.8	0.0
I	6.25	200	2,726	4.4	8.8	8.8	8.8	0.0
J	7.62	213	2,432	5.3	9.9	9.9	9.9	0.0
K	8.12	250	2,668	4.8	11.4	11.4	11.4	0.0
L	8.47	290	3,555	3.6	12.3	12.3	12.3	0.0
M	8.86	190	2,464	5.2	13.0	13.0	13.0	0.0
N	8.97	186	2,363	5.4	13.3	13.3	13.3	0.0
O	9.06	165	2,051	6.2	13.5	13.5	13.5	0.0
P	9.24	188	2,883	4.4	14.2	14.2	14.2	0.0
Q	9.48	134	2,645	4.8	14.4	14.4	14.5	0.1
R	10.63	176	2,654	4.8	17.5	17.5	17.6	0.1
S	10.79	163	3,247	3.9	18.1	18.1	18.2	0.1
T	10.87	163	2,735	4.7	18.3	18.3	18.4	0.1
U	10.92	216	3,576	3.6	18.6	18.6	18.8	0.2
V	11.18	150	2,571	4.7	19.4	19.4	19.5	0.1
W	11.48	140	2,576	4.7	20.0	20.0	20.2	0.2
X	11.68	180	2,884	4.2	20.3	20.3	20.6	0.3
Y	11.83	175	2,568	4.7	20.6	20.6	21.0	0.4

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (Without Levees) Cont'd								
Z	12.02	180	3,082	3.9	21.1	21.1	21.5	0.4
AA	12.23	215	3,701	3.3	21.5	21.5	21.8	0.3
AB	12.39	137	2,546	4.8	21.6	21.6	21.9	0.3
AC	12.60	185	3,076	3.9	22.4	22.4	22.7	0.3
AD	12.72	183	3,023	4.0	22.7	22.7	23.0	0.3
AE	12.91	168	3,103	3.9	23.2	23.2	23.5	0.3
AF	13.07	175	3,015	4.0	23.5	23.5	23.8	0.3
AG	13.20	174	2,999	4.0	23.8	23.8	24.1	0.3
AH	13.38	166	2,720	4.4	24.2	24.2	24.4	0.2
AI	13.52	209	3,137	3.9	24.6	24.6	24.8	0.2
AJ	13.70	128	2,512	4.8	25.0	25.0	25.2	0.2
AK	13.93	139	2,581	4.7	25.4	25.4	25.6	0.2
AL	14.18	160	2,661	4.5	25.8	25.8	26.2	0.4
AM	14.46	152	2,856	4.2	26.3	26.3	26.8	0.5
AN	14.48	163	2,821	4.3	26.3	26.3	26.8	0.5
AO	14.68	141	2,463	4.9	26.6	26.6	27.2	0.6
AP	14.90	152	2,660	4.5	27.2	27.2	27.7	0.5
AQ	14.94	179	2,844	4.3	27.3	27.3	27.8	0.5
AR	15.14	155	3,017	4.0	27.6	27.6	28.2	0.6
AS	15.39	142	2,679	4.5	27.9	27.9	28.6	0.7
AT	15.73	161	3,112	3.9	28.2	28.2	29.1	0.9
AU	16.01	185	3,381	3.6	28.6	28.6	29.5	0.9
AV	16.33	174	2,735	4.4	29.1	29.1	30.0	0.9
AW	16.54	175	3,193	3.8	29.6	29.6	30.4	0.8

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (Without Levees Cont'd)								
AX	16.76	196	3,561	3.4	29.9	29.9	30.7	0.8
AY	16.94	165	2,815	4.3	30.1	30.1	30.9	0.8
AZ	17.15	151	2,864	4.2	30.5	30.5	31.2	0.7
BA	17.36	158	2,773	4.4	30.9	30.9	31.6	0.7
BB	17.56	167	2,913	4.2	31.3	31.3	31.9	0.6
BC	17.77	161	2,633	4.6	31.7	31.7	32.3	0.6
BD	17.99	176	2,868	4.2	32.3	32.3	32.9	0.6
BE	18.10	182	3,061	4.0	32.7	32.7	33.2	0.5
BF	18.44	192	3,148	3.8	33.1	33.1	33.6	0.5
BG	18.74	186	2,818	4.3	33.6	33.6	34.0	0.4
BH	18.94	183	3,247	3.7	34.1	34.1	34.5	0.4
BI	19.18	162	2,859	4.2	34.4	34.4	34.8	0.4
BJ	19.35	206	2,993	4.0	34.7	34.7	35.1	0.4
BK	19.51	176	3,088	3.9	35.1	35.1	35.4	0.3
BL	19.75	176	3,042	4.0	35.4	35.4	35.7	0.3
BM	20.01	202	3,664	3.3	35.8	35.8	36.1	0.3
BN	20.24	186	3,297	3.7	36.1	36.1	36.4	0.3
BO	20.47	179	3,219	3.8	36.4	36.4	36.7	0.3
BP	20.68	171	3,044	4.0	36.6	36.6	36.9	0.3
BQ	20.87	167	3,141	3.9	36.9	36.9	37.2	0.3
BR	20.99	152	2,869	4.2	37.1	37.1	37.4	0.3
BS	21.23	188	2,977	4.1	37.5	37.5	37.7	0.2
BT	21.38	199	3,262	3.7	37.8	37.8	38.0	0.2
BU	21.62	176	3,034	4.0	38.1	38.1	38.3	0.2

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Green River (Without Levees Cont'd)								
BV	21.91	147	2,735	4.4	38.6	38.6	38.8	0.2
BW	22.11	149	2,931	4.1	39.0	39.0	39.2	0.2
BX	22.38	184	2,993	4.0	39.4	39.4	39.6	0.2
BY	22.59	171	3,085	3.9	39.7	39.7	39.9	0.2
BZ	22.88	179	3,128	3.9	40.1	40.1	40.3	0.2
CA	23.10	197	3,146	3.8	40.4	40.4	40.6	0.2
CB	23.27	197	3,206	3.8	40.7	40.7	40.9	0.2
CC	23.53	184	3,067	3.9	41.2	41.2	41.4	0.2
CD	23.71	168	2,948	4.1	41.5	41.5	41.7	0.2
CE	23.89	175	3,026	4.0	41.9	41.9	42.1	0.2
CF	24.06	171	2,899	4.1	42.2	42.2	42.4	0.2
CG	24.10	147	2,576	4.7	42.2	42.2	42.4	0.2
CH	24.30	156	2,595	4.6	42.7	42.7	42.9	0.2
CI	24.44	154	2,735	4.4	43.0	43.0	43.2	0.2
CJ	24.63	147	2,517	4.8	43.3	43.3	43.5	0.2
CK	24.89	175	2,601	4.6	43.8	43.8	43.9	0.1
CL	25.12	160	3,202	3.7	44.2	44.2	44.4	0.2
CM	25.14	205	2,903	4.1	44.2	44.2	44.4	0.2
CN	25.30	155	2,596	4.6	44.5	44.5	44.6	0.1
CO	25.62	150	2,837	4.2	45.0	45.0	45.1	0.1
CP	25.90	167	2,762	4.3	45.4	45.4	45.5	0.1
CQ	26.15	223	2,909	4.1	46.0	46.0	46.1	0.1
CR	26.44	159	2,774	4.3	46.6	46.6	46.7	0.1
CS	26.68	265	3,828	3.1	47.1	47.1	47.2	0.1

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (Without Levees) Cont'd								
CT	26.93	248	2,982	4.0	47.4	47.4	47.5	0.1
CU	27.15	202	3,156	3.8	47.8	47.8	47.9	0.1
CV	27.36	211	3,695	3.2	48.2	48.2	48.3	0.1
CW	27.60	148	2,168	5.5	48.3	48.3	48.4	0.1
CX	27.88	216	3,168	3.8	49.3	49.3	49.4	0.1
CY	28.04	127	2,019	5.9	49.5	49.5	49.5	0.0
CZ	28.24	156	2,119	5.7	49.8	49.8	50.3	0.5
DA	28.43	118	1,701	7.1	50.6	50.6	51.1	0.5
DB	28.68	162	2,123	5.7	52.1	52.1	52.5	0.4
DC	28.87	150	1,918	6.3	52.6	52.6	52.9	0.3
DD	29.03	171	2,081	5.8	53.3	53.3	53.6	0.3
DE	29.25	159	1,891	6.3	54.0	54.0	54.2	0.2
DF	29.45	184	2,019	5.9	54.8	54.8	55.1	0.3
DG	29.73	160	1,857	6.5	55.9	55.9	56.1	0.2
DH	29.94	166	1,723	7.0	56.9	56.9	57.1	0.2
DI	30.21	217	1,871	6.4	58.5	58.5	58.6	0.1
DJ	30.39	158	1,532	7.8	59.3	59.3	59.4	0.1
DK	30.59	237	1,948	6.1	61.0	61.0	61.0	0.0
DL	30.81	309	2,538	4.7	62.1	62.1	62.1	0.0
DM	30.98	182	1,696	7.1	62.4	62.4	62.4	0.0
DN	31.07	126	1,900	6.3	62.9	62.9	62.9	0.0
DO	31.28	185	1,891	6.3	63.6	63.6	63.7	0.1
DP	31.58	151	1,971	6.1	64.7	64.7	64.7	0.0
DQ	31.90	126	1,642	7.3	65.8	65.8	65.8	0.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (Without Levees) Cont'd								
DR	32.25	185	2,131	5.6	67.4	67.4	67.8	0.4
DS	32.58	1,247	6,579	1.8	68.5	68.5	69.1	0.6
DT	32.85	1,512	6,846	1.8	69.2	69.2	69.6	0.4
DU	33.10	841	4,091	2.9	69.8	69.8	70.2	0.4
DV	33.33	542	2,956	4.1	70.7	70.7	71.0	0.3
DW	33.55	225	1,924	6.2	72.0	72.0	72.9	0.9
DX	33.72	271	2,175	5.5	73.3	73.3	74.1	0.8
DY	33.78	180	1,808	6.6	73.7	73.7	74.4	0.7
DZ	33.82	265	2,294	5.2	74.4	74.4	75.0	0.6
EA	33.38	225	2,010	6.0	74.8	74.8	75.1	0.3
EB	34.18	212	1,484	7.8	76.7	76.7	77.0	0.3
EC	34.64	208	1,644	7.1	80.0	80.0	80.8	0.8
ED	35.00	256	1,891	6.1	83.3	83.3	83.4	0.1
EE	35.30	200	1,610	7.2	84.9	84.9	84.9	0.0
EF	35.74	237	1,846	6.3	87.9	87.9	87.9	0.0
EG	36.08	314	1,891	6.1	90.6	90.6	90.6	0.0
EH	36.33	231	1,415	8.2	92.7	92.7	92.8	0.1
EI	36.78	234	2,093	5.5	97.4	97.4	98.2	0.8
EJ	37.17	336	2,254	5.1	100.5	100.5	100.9	0.4
EK	37.48	574	2,863	4.1	103.2	103.2	103.5	0.3
EL	37.71	621	2,574	4.5	105.0	105.0	105.4	0.4
EM	38.23	648	2,489	4.7	110.3	110.3	111.3	1.0
EN	38.52	287	1,697	6.8	114.5	114.5	115.3	0.8
EO	38.94	329	2,265	5.1	120.3	120.3	121.3	1.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (Without Levees)								
EP	39.18	735	3,567	3.3	123.1	123.1	123.4	0.3
EQ	39.55	905	3,077	3.8	125.6	125.6	126.1	0.5
ER	40.16	482	1,926	6.0	135.5	135.5	136.5	1.0
ES	40.33	202	1,415	8.2	139.1	139.1	139.7	0.6
ET	40.83	278	1,780	6.5	148.9	148.9	148.8	0.0
EU	41.08	370	1,426	8.1	153.0	153.0	153.2	0.2
EV	41.44	225	1,593	7.2	159.5	159.5	160.1	0.6
EW	41.76	330	1,687	6.8	165.5	165.5	165.7	0.2
EX	41.90	220	1,552	7.4	167.6	167.6	167.7	0.1
EY	42.14	201	1,485	7.7	170.8	170.8	170.9	0.1
EZ	42.40	261	1,268	9.1	176.6	176.6	176.6	0.0
FA	42.78	186	1,242	9.3	187.6	187.6	187.6	0.0
FB	43.29	310	1,848	6.2	197.0	197.0	197.0	0.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITHOUT LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[3] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY[4]	WITHOUT[4] FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (With Levees)								
A-U[2]								
V	11.18	--[3]	--[3]	--[3]	19.4	19.4	--[3]	--[3]
W	11.48	--[3]	--[3]	--[3]	20.0	20.0	--[3]	--[3]
X	11.68	--[3]	--[3]	--[3]	20.5	20.5	--[3]	--[3]
Y	11.83	--[3]	--[3]	--[3]	20.8	20.8	--[3]	--[3]
Z	12.02	--[3]	--[3]	--[3]	21.4	21.4	--[3]	--[3]
AA	12.23	--[3]	--[3]	--[3]	21.7	21.7	--[3]	--[3]
AB	12.39	--[3]	--[3]	--[3]	21.8	21.8	--[3]	--[3]
AC	12.60	--[3]	--[3]	--[3]	22.6	22.6	--[3]	--[3]
AD	12.72	--[3]	--[3]	--[3]	22.9	22.9	--[3]	--[3]
AE	12.91	--[3]	--[3]	--[3]	23.4	23.4	--[3]	--[3]
AF	13.07	--[3]	--[3]	--[3]	23.7	23.7	--[3]	--[3]
AG	13.20	--[3]	--[3]	--[3]	23.9	23.9	--[3]	--[3]
AH	13.38	--[3]	--[3]	--[3]	24.4	24.4	--[3]	--[3]
AI	13.52	--[3]	--[3]	--[3]	24.8	24.8	--[3]	--[3]
AJ	13.70	--[3]	--[3]	--[3]	25.1	25.1	--[3]	--[3]
AK	13.93	--[3]	--[3]	--[3]	25.6	25.6	--[3]	--[3]
AL	14.18	--[3]	--[3]	--[3]	26.1	26.1	--[3]	--[3]
AM	14.46	--[3]	--[3]	--[3]	26.7	26.7	--[3]	--[3]
AN	14.48	--[3]	--[3]	--[3]	26.7	26.7	--[3]	--[3]
AO	14.68	--[3]	--[3]	--[3]	27.1	27.1	--[3]	--[3]
AP	14.90	--[3]	--[3]	--[3]	27.7	27.7	--[3]	--[3]
AQ	14.94	--[3]	--[3]	--[3]	27.8	27.8	--[3]	--[3]
AR	15.14	--[3]	--[3]	--[3]	28.2	28.2	--[3]	--[3]
AS	15.39	--[3]	--[3]	--[3]	28.5	28.5	--[3]	--[3]
AT	15.73	--[3]	--[3]	--[3]	29.2	29.2	--[3]	--[3]

[1]Miles Above Mouth [2]No Levees Along Channel for These Cross Sections
[3]Refer to Green River Without Levees Floodway Data Table for Regulatory Floodway Based on Assumed Levee System Removals
[4]Represents Base Flood Elevations Within Main Channel with Flow Confined Within Levee System

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITH LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY[3]	WITHOUT[3] FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (With Levees) (Cont'd)								
AU	16.01	--2	--2	--2	29.5	29.5	--2	--2
AV	16.33	--2	--2	--2	29.9	29.9	--2	--2
AW	16.54	--2	--2	--2	30.4	30.4	--2	--2
AX	16.76	--2	--2	--2	30.7	30.7	--2	--2
AY	16.94	--2	--2	--2	30.8	30.8	--2	--2
AZ	17.15	--2	--2	--2	31.2	31.2	--2	--2
BA	17.36	--2	--2	--2	31.5	31.5	--2	--2
BB	17.56	--2	--2	--2	31.9	31.9	--2	--2
BC	17.77	--2	--2	--2	32.3	32.3	--2	--2
BD	17.99	--2	--2	--2	32.8	32.8	--2	--2
BE	18.20	--2	--2	--2	33.2	33.2	--2	--2
BF	18.44	--2	--2	--2	33.5	33.5	--2	--2
BG	18.74	--2	--2	--2	34.0	34.0	--2	--2
BH	18.94	--2	--2	--2	34.4	34.4	--2	--2
BI	19.18	--2	--2	--2	34.8	34.8	--2	--2
BJ	19.33	--2	--2	--2	35.1	35.1	--2	--2
BK	19.51	--2	--2	--2	35.4	35.4	--2	--2
BL	19.75	--2	--2	--2	35.7	35.7	--2	--2
BM	20.01	--2	--2	--2	36.1	36.1	--2	--2
BN	20.24	--2	--2	--2	36.3	36.3	--2	--2
BO	20.47	--2	--2	--2	36.6	36.6	--2	--2
BP	20.68	--2	--2	--2	36.9	36.9	--2	--2
BQ	20.87	--2	--2	--2	37.2	37.2	--2	--2
BR	20.99	--2	--2	--2	37.3	37.3	--2	--2

[1]Miles Above Mouth
[2]Refer to Green River Without Levees Floodway Data Table for Regulatory Floodway Based on Assumed Levee System Removals
[3]Represents Base Flood Elevations Within Main Channel with Flow Confined Within Levee System

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITH LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY[3]	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (With Levees) (Cont'd)								
BS	21.23	--2	--2	--2	37.7	37.7	--2	--2
BT	21.38	--2	--2	--2	38.0	38.0	--2	--2
BU	21.62	--2	--2	--2	38.3	38.3	--2	--2
BV	21.91	--2	--2	--2	38.8	38.8	--2	--2
BW	22.11	--2	--2	--2	39.1	39.1	--2	--2
BX	22.38	--2	--2	--2	39.5	39.5	--2	--2
BY	22.59	--2	--2	--2	39.9	39.9	--2	--2
BZ	22.88	--2	--2	--2	40.3	40.3	--2	--2
CA	23.10	--2	--2	--2	40.6	40.6	--2	--2
CB	23.27	--2	--2	--2	40.9	40.9	--2	--2
CC	23.53	--2	--2	--2	41.4	41.4	--2	--2
CD	23.71	--2	--2	--2	41.7	41.7	--2	--2
CE	23.89	--2	--2	--2	42.1	42.1	--2	--2
CF	24.06	--2	--2	--2	42.3	42.3	--2	--2
CG	24.01	--2	--2	--2	42.4	42.4	--2	--2
CH	24.30	--2	--2	--2	42.8	42.8	--2	--2
CI	24.44	--2	--2	--2	43.1	43.1	--2	--2
CJ	24.63	--2	--2	--2	43.4	43.4	--2	--2
CK	24.89	--2	--2	--2	43.9	43.9	--2	--2
CL	25.12	--2	--2	--2	44.3	44.3	--2	--2
CM	25.14	--2	--2	--2	44.3	44.3	--2	--2
CN	25.00	--2	--2	--2	44.6	44.6	--2	--2
CO	25.62	--2	--2	--2	45.1	45.1	--2	--2
CP	25.90	--2	--2	--2	45.5	45.5	--2	--2

[1]Miles Above Mouth
[2]Refer to Green River Without Levees Floodway Data Table for Regulatory Floodway Based on Assumed Levee System Removals
[3]Represents Base Flood Elevations Within Main Channel with Flow Confined Within Levee System

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITH LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY[3]	WITHOUT[3] FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Green River (With Levees) (Cont'd)								
CQ	26.15	--[2]	--[2]	--[2]	46.1	46.1	--[2]	--[2]
CR	26.64	--[2]	--[2]	--[2]	46.6	46.6	--[2]	--[2]
CS	26.68	--[2]	--[2]	--[2]	47.1	47.1	--[2]	--[2]
CT	26.93	--[2]	--[2]	--[2]	47.4	47.4	--[2]	--[2]
CU	27.15	--[2]	--[2]	--[2]	47.9	47.9	--[2]	--[2]
CV	27.36	--[2]	--[2]	--[2]	48.2	48.2	--[2]	--[2]
CW	27.60	--[2]	--[2]	--[2]	48.3	48.3	--[2]	--[2]
CX	27.88	--[2]	--[2]	--[2]	49.3	49.3	--[2]	--[2]
CY	28.04	--[2]	--[2]	--[2]	49.6	49.6	--[2]	--[2]
CZ	28.24	--[2]	--[2]	--[2]	49.8	49.8	--[2]	--[2]
DA	28.43	--[2]	--[2]	--[2]	50.6	50.6	--[2]	--[2]
DB	28.68	--[2]	--[2]	--[2]	52.1	52.1	--[2]	--[2]
DC	28.87	--[2]	--[2]	--[2]	52.6	52.6	--[2]	--[2]
DD	29.03	--[2]	--[2]	--[2]	53.3	53.3	--[2]	--[2]
DE	29.25	--[2]	--[2]	--[2]	54.0	54.0	--[2]	--[2]
DF	29.45	--[2]	--[2]	--[2]	54.8	54.8	--[2]	--[2]
DG	29.73	--[2]	--[2]	--[2]	55.9	55.9	--[2]	---[2]
DH	29.94	--[2]	--[2]	--[2]	56.9	56.9	--[2]	--[2]
DI	30.21	--[2]	--[2]	--[2]	58.5	58.5	--[2]	--[2]
DJ	30.39	--[2]	--[2]	--[2]	59.3	59.3	---[2]	--[2]
DK	30.59	--[2]	--[2]	--[2]	61.0	61.0	--[2]	--[2]
DL	30.81	--[2]	--[2]	--[2]	62.1	62.1	--[2]	--[2]
DM	30.98	--[2]	--[2]	--[2]	62.4	62.4	--[2]	--[2]
DN	31.07	--[2]	--[2]	--[2]	62.9	62.9	--[2]	--[2]

[1]Miles Above Mouth
[2]Refer to Green River Without Levees Floodway Data Table for Regulatory Floodway Based on Assumed Levee System Removals
[3]Represents Base Flood Elevations Within Main Channel with Flow Confined Within Levee System

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITH LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY[3]	WITHOUT[3] FLOODWAY	WITH FLOODWAY	INCREASE
Green River (With Levees) (Cont'd)								
DO	31.28	--2	--2	--2	63.6	63.6	--2	--2
DP	31.58	--2	--2	--2	64.7	64.7	--2	--2
DQ	31.90	--2	--2	--2	65.8	65.8	--2	--2
DR	32.25	--2	--2	--2	67.4	67.4	--2	--2
DS	32.58	--2	--2	--2	68.5	68.5	--2	--2
DT	32.85	--2	--2	--2	69.2	69.2	--2	--2
DU	33.10	--2	--2	--2	69.8	69.8	--2	--2
DV	33.33	--2	--2	--2	70.7	70.7	--2	--2
DW	33.55	--2	--2	--2	72.7	72.7	--2	--2
DX	33.72	--2	--2	--2	73.8	73.8	--2	--2
DY	33.78	--2	--2	--2	74.1	74.1	--2	--2
DZ	33.82	--2	--2	--2	74.8	74.8	--2	--2

[1]Miles Above Mouth
[2]Refer to Green River Without Levees Floodway Data Table for Regulatory Floodway Based on Assumed Levee System Removals
[3]Represents Base Flood Elevations Within Main Channel with Flow Confined Within Levee System

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

GREEN RIVER (WITH LEVEES)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Holder Creek								
A	470	79	122	6.6	403.6	403.6	403.6	0.0
B	1,830	40	130	6.2	424.7	424.7	424.8	0.1
C	2,625	20	84	9.6	437.7	437.7	438.4	0.7
D	3,460	30	119	6.7	453.0	453.0	453.7	0.7
E	4,735	23	82	9.8	476.4	476.4	476.6	0.2
F	4,830	42	133	6.0	478.4	478.4	479.3	0.9
G	4,900	38	145	5,5	480.1	480.1	480.1	0.0
H	4,935	29	83	9.7	480.6	480.6	480.8	0.2
I	5,500	19	86	9.3	493.5	493.5	494.3	0.8

[1]Mile Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

HOLDER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
ISSAQUAH CREEK								
A	950	1950	2,974	2.2	34.5	34.5	34.5	0.0
B	1,954	1650	1,422	3.3	36.3	36.3	36.3	0.0
C	3,590	1000	936	3.4	42.9	42.9	42.9	0.0
D	5,554	265	1,610	2.5	47.3	47.3	48.3	1.0
E	6,517	255	1,534	2.6	49.5	49.5	50.5	1.0
F	7,095	273	1,492	2.6	50.6	50.6	51.4	0.8
G	7,855	127	884	4.0	54.3	54.3	55.2	0.9
H	8,716	210	970	4.3	56.2	56.2	57.1	0.8
I	9,458	62	535	6.7	58.4	58.4	59.2	0.8
J	9,828	86	787	4.5	60.5	60.5	61.1	0.7
K	10,078	86	705	5.1	61.0	61.0	61.6	0.6
L	10,507	88	797	4.5	61.9	61.9	62.7	0.8
M	10,867	93	828	5.0	63.7	63.7	64.4	0.7
N	11,402	80	739	5.6	65.2	65.2	65.9	0.7
O	11,869	71	616	6.8	66.9	66.9	67.4	0.5
P	12,193	115	881	4.7	68.7	68.7	69.3	0.6
Q	12,750	71	611	6.8	69.5	69.5	70.5	0.9
R	13,033	210	1,168	3.6	70.8	70.8	71.9	1.0
S	13,454	123	734	5.7	71.3	71.3	72.2	0.8
T	13,727	89	568	7.3	73.0	73.0	73.9	0.9
U	14,021	59	566	5.9	75.9	75.9	76.7	0.8
V	14,693	195	969	3.5	79.9	79.9	80.7	0.8
W	15,157	58	641	5.2	81.3	81.3	82.2	0.8
X	15,518	68	623	5.4	82.4	82.4	83.3	0.9
Y	16,199	77	689	4.9	85.0	85.0	85.7	0.7
Z	16,752	61	536	6.3	86.6	86.6	87.3	0.7

1 Stream Distance in Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD - WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY FEET (NGVD)	WITH FLOODWAY FEET (NGVD)	INCREASE
ISSAQUAH CREEK								
AA	17,344	97	609	5.5	88.1	88.1	88.9	0.8
AB	17,469	64	560	6.0	88.7	88.7	89.4	0.8
AC	17,744	110	575	5.8	91.3	91.3	91.7	0.4
AD	17,950	110	552	6.1	91.6	91.6	92.1	0.5
AE	18,436	85	521	6.4	92.6	92.6	93.0	0.4
AF	18,734	100	494	6.7	92.8	92.8	93.6	0.7
AG	19,019	125	502	6.6	93.9	93.9	94.5	0.6
AH	19,214	152	991	3.3	95.3	95.3	95.7	0.4
AI	19,814	60	401	8.3	97.4	97.4	98.2	0.7
AJ	20,439	69	508	6.5	100.3	100.3	101.3	1.0
AK	20,953	79	516	6.4	101.9	101.9	102.6	0.7
AL	21,223	102	633	5.2	102.6	102.6	103.4	0.8
AM	21,761	82	532	6.1	113.7	113.7	114.0	0.3
AN	22,914	351	1,852	1.8	117.2	117.2	118.1	0.9
AO	23,852	483	1,876	1.7	120.3	120.3	121.0	0.7
AP	24,254	475	2,235	1.5	121.7	121.7	122.7	1.0
AQ	24,687	524	1,154	2.8	123.1	123.1	123.9	0.8
AR	25,056	755	1,971	1.7	125.2	125.2	126.2	1.0
AS	25,980	97	558	5.7	130.7	130.7	131.6	0.8
AT	26,749	53	394	8.0	133.2	133.2	133.8	0.6
AU	27,306	85	472	6.4	134.7	134.7	135.3	0.6
AV	27,875	46	291	10.3	137.4	137.4	137.6	0.2
AW	28,169	48	283	10.6	138.9	138.9	138.9	0.0
AX	28,399	49	321	9.3	140.1	140.1	140.5	0.4
AY	28,406	66	496	6.2	143.6	143.6	144.6	1.0
AZ	28,934	73	618	4.9	145.7	145.7	146.7	1.0

1 Stream Distance in Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Issaquah Creek (Cont'd)								
BA	29,462.4	98	582	5.2	146.5	146.5	147.5	1.0
BB	30,096.0	19	488	6.3	149.4	149.4	150.0	0.6
BC	31,152.0	85	463	6.6	152.8	152.8	153.0	0.2
BD	32,208.0	84	476	6.4	156.0	156.0	156.3	0.3
BE	33,422.4	163	569	5.3	160.0	160.0	160.2	0.2
BF	34,478.4	170	452	6.4	166.7	166.7	167.2	0.5
BG	35,798.4	292	826	3.5	175.6	175.6	176.6	1.0
BH	36,960.0	74	294	9.8	182.1	182.1	182.1	0.0
BI	37,224.0	74	449	6.4	188.8	188.8	188.9	0.1
BJ	38,121.6	103	389	7.4	191.2	191.2	191.2	0.0
BK	38,702.4	119	368	7.8	196.9	196.9	197.1	0.2
BL	39,230.4	52	198	14.5	200.2	200.2	200.4	0.2
BM	40,022.4	120	510	5.6	210.9	210.9	210.9	0.0
BN	41,078.4	96	344	8.4	218.6	218.6	218.6	0.0
BO	42,345.6	52	280	10.3	224.0	224.0	224.0	0.0
BP	42,451.2	68	386	6.3	225.6	225.6	225.6	0.0
BQ	43,032.0	67	243	10.0	228.2	228.2	228.4	0.2
BR	43,401.6	45	281	7.2	229.8	229.8	230.8	1.0
BS	44,193.6	43	175	11.6	233.9	233.9	233.9	0.0
BT	45,196.8	40	232	8.7	240.2	240.2	240.5	0.3
BU	45,355.2	39	182	11.1	240.8	240.8	241.1	0.3
BV	45,460.8	44	374	5.4	245.3	245.3	245.3	0.0
BW	45,566.4	41	340	5.9	245.4	245.4	245.4	0.0
BX	46,728.0	32	159	12.7	248.4	248.4	248.4	0.0
BY	47,520.0	37	188	10.7	255.6	255.6	256.1	0.5
BZ	48,945.6	52	224	9.0	265.0	265.0	265.2	0.2

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Issaquah Creek (Cont'd)								
CA	50,001.6	118	350	5.8	269.4	269.4	269.9	0.5
CB	50,952.0	219	387	5.2	275.4	275.4	275.4	0.0
CC	51,796.8	48	182	11.1	280.8	280.8	280.9	0.1
CD	52,800.0	132	433	4.7	287.9	287.9	288.7	0.8
CE	52,958.4	42	235	8.1	288.9	288.9	289.9	1.0
CF	53,011.2	42	216	8.9	291.3	291.3	291.3	0.0
CG	53,116.8	192	634	3.0	292.8	292.8	292.8	0.0
CH	53,222.4	38	271	7.1	293.0	293.0	293.1	0.1
CI	53,380.8	184	885	2.2	294.2	294.2	294.4	0.2
CJ	54,595.2	125	247	7.7	300.1	300.1	300.1	0.0
CK	55,334.5	165	554	3.4	305.0	305.0	306.0	1.0
CL	56,284.8	193	320	6.0	310.5	310.5	310.7	0.2
CM	56,601.6	41	251	7.6	312.5	312.5	313.5	1.0
CN	57,921.6	39	213	9.0	321.2	321.2	321.6	0.4
CO	59,664.0	51	267	6.2	331.5	331.5	332.4	0.9
CP	59,769.5	45	233	7.2	332.1	332.1	332.9	0.8
CQ	59,822.4	51	340	4.9	334.4	334.4	334.6	0.2
CR	59,875.2	54	332	5.0	334.8	334.8	334.8	0.0
CS	61,036.8	40	172	9.7	339.3	339.3	339.7	0.4
CT	62,515.2	58	242	6.9	351.8	351.8	352.7	0.9
CU	63,571.2	53	269	6.2	359.1	359.1	360.1	1.0
CV	65,102.4	35	186	9.0	375.4	375.4	375.4	0.0
CW	66,528.0	47	283	5.9	387.8	387.8	388.7	0.9

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[2] FLOODWAY (FEET NGVD)	WITH[2] FLOODWAY (FEET NGVD)	INCREASE
Little Bear Creek								
A	40	39	289	1.7	24.1	23.8	23.8	0.0
B	177	8	78	6.4	25.6	25.6	25.6	0.0
C	427	14	97	5.2	26.4	26.4	26.7	0.3
D	577	24	70	7.1	26.3	26.3	27.0	0.7
E	617	19	52	9.6	27.3	27.3	27.3	0.0
F	764	39	182	2.7	33.3	33.3	33.4	0.1
G	849	31	102	4.9	33.3	33.3	33.4	0.1
H	949	49	124	4.4	33.8	33.8	33.9	0.1
I	1,059	55	247	2.3	36.3	36.3	36.3	0.0
J	1,159	44	179	3.2	36.5	36.5	36.5	0.0
K	1,199	50	194	2.9	36.5	36.5	36.5	0.0
L	1,224	31	137	4.1	36.5	36.5	36.5	0.0
M	1,413	26	157	3.6	38.2	38.2	38.2	0.0
N	1,493	31	183	3.1	38.3	38.3	38.4	0.1
O	1,773	32	109	5.2	38.5	38.5	38.6	0.1
P	1,979	11	51	11.0	42.8	42.8	43.2	0.4
Q	2,103	24	174	3.3	45.7	45.7	45.7	0.0
R	2,792	20	104	5.4	48.3	48.3	49.1	0.8
S	3,642	34	130	4.4	53.7	53.7	54.1	0.4
T	4,602	38	89	6.4	60.9	60.9	61.3	0.4
U	5,122	28	129	4.4	64.4	64.4	65.4	1.0
V	5,962	24	94	6.0	69.3	69.3	69.9	0.6
W	6,652	45	303	1.8	80.9	80.9	80.9	0.0
X	7,052	24	111	4.8	81.1	81.1	81.6	0.5

[1]Feet Above Mouth [2]Elevations Computed With Consideration of 25-Year Sammamish River Backwater Elevation

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[2] FLOODWAY (FEET NGVD)	WITH[2] FLOODWAY (FEET NGVD)	INCREASE
Little Bear Creek (Cont'd)								
Y	7,452	36	175	3.1	83.6	83.6	84.6	1.0
Z	7,762	23	148	3.6	90.7	90.7	90.7	0.0
AA	8,162	27	150	3.6	91.2	91.2	92.2	1.0
AB	9,522	21	73	7.4	100.9	100.9	101.7	0.8
AC	10,562	23	136	4.0	110.4	110.4	111.0	0.6
AD	10,742	46	247	2.2	110.9	110.9	111.5	0.6

[1]Feet Above Mouth [2]Elevations Computed With Consideration of 25-Year Sammamish River Backwater Elevation

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Longfellow Creek								
A	11,210	9	84	4.5	116.9	116.9	116.9	0.0
B	11,360	31	197	1.9	117.2	117.2	117.3	0.1
C	11,650	18	71	5.3	117.2	117.2	117.3	0.1
D	12,150	54	145	2.6	118.8	118.8	119.8	1.0
E	12,380	15	64	5.4	122.2	122.2	123.1	0.9
F	12,650	12	54	6.5	123.5	123.5	124.4	0.9
G	12,810	13	59	5.3	124.4	124.4	125.4	1.0
H	12,920	14	88	3.5	127.7	127.7	128.7	1.0
I	13,100	11	57	5.4	127.9	127.9	128.9	1.0
J	13,780	12	37	8.4	132.1	132.1	132.6	0.5
K	14,230	19	49	6.3	136.8	136.8	137.8	1.0
L	14,290	12	41	7.6	137.9	137.9	138.1	0.2
M	14,410	39	130	2.4	139.7	139.7	140.6	0.9
N	14,830	13	43	7.2	140.5	140.5	141.2	0.7
O	15,010	41	212	1.4	146.6	146.6	147.6	1.0
P	15,280	48	223	1.3	146.9	146.9	147.8	0.9
Q	15,475	36	126	2.3	148.6	148.6	149.6	1.0
R	16,200	21	57	5.0	151.3	151.3	152.0	0.7
S	16,230	10	50	5.6	152.0	152.0	152.2	0.2
T	16,480	70	308	0.9	158.5	158.5	159.5	1.0
U	16,850	18	38	7.4	159.0	159.0	159.5	0.5
V	17,165	13	46	6.1	165.6	165.6	165.9	0.3
W	17,245	25	78	3.6	166.5	166.5	167.0	0.5
X	19,555	12	20	7.4	226.5	226.5	226.5	0.0
Y	19,835	10	18	7.7	232.5	232.5	232.5	0.0
Z	20,455	35	45	3.1	241.4	241.4	241.4	0.0
AA	21,575	13	23	6.1	253.2	253.2	253.2	0.0

[1] Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

LONGFELLOW CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NGVD)		
LOWER OVERFLOW								
A	1,280	203	1,443	1.0	428.9	427.6[2]	428.4[2]	0.8
B	2,380	126	586	2.4	434.0	429.8[2]	430.5[2]	0.7
C	3,155	147	331	4.2	435.2	432.2[2]	432.8[2]	0.6
D	3,855	99	281	5.0	436.8	436.5[2]	436.5[2]	0.0
E	4,805	95	274	5.1	440.3	440.3	440.4	0.1
F	5,855	162	556	4.1	447.5	447.5	448.4	0.9
G	6,555	306	1,258	1.8	448.8	448.8	449.4	0.6
H	6,980	192	325	7.1	451.0	449.1[2]	450.1[2]	1.0

[1] Stream distance in feet above convergence with South Fork Snoqualmie River.
[2] Elevations computed without backwater effects from Middle Fork Snoqualmie River.

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

LOWER OVERFLOW

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Maloney Creek								
A	100	27	197	5.7	922.5	916.1[2]	917.1[2]	1.0
B	175	55	270	4.2	922.5	916.8[2]	917.8[2]	1.0
C	240	28	178	6.3	922.5	917.5[2]	918.0[2]	0.5
D	550	64	257	4.4	922.5	918.2[2]	919.0[2]	0.8
E	885	29	126	9.0	922.5	919.3[2]	920.2[2]	0.9
F	990	58	208	5.4	922.5	921.5[2]	921.5[2]	0.0
G	1,440	98	324	3.5	922.7	922.7	923.5	0.8

[1]Feet Above Mouth

[2]Elevation Computed Without Consideration of Backwater Effects From South Fork Skykomish River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MALONEY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
May Creek								
A	0.14	34	158	5.5	21.0	21.0	21.5	0.5
B	0.16	60	239	3.6	21.8	21.8	22.2	0.4
C	0.24	42	99	8.8	23.3	23.3	23.3	0.0
D	0.25	42	110	7.9	25.7	25.7	25.7	0.0
E	0.31	31	121	7.2	29.0	29.0	29.2	0.2
F	0.39	40	150	5.8	32.5	32.5	33.0	0.5
G	0.46	28	87	10.0	35.8	35.8	35.8	0.0
H	0.52	23	123	7.1	40.0	40.0	40.6	0.6
I	0.57	45	165	5.3	41.8	41.8	42.5	0.7
J	0.63	31	89	9.7	45.3	45.3	45.3	0.0
K	0.78	33	133	6.5	55.2	55.2	55.2	0.0
L	0.94	79	143	6.1	64.7	64.7	64.7	0.0
M	1.09	33	113	7.7	76.4	76.4	76.6	0.2
N	1.25	39	128	6.6	85.4	85.4	85.4	0.0
O	1.36	32	89	9.6	93.1	93.1	93.2	0.1
P	1.39	40	172	4.9	95.6	95.6	96.0	0.4
Q	1.41	33	90	9.5	95.8	95.8	95.8	0.0
R	1.42	33	111	7.7	96.4	96.4	96.4	0.0
S	1.46	30	95	8.9	99.8	99.8	99.9	0.1
T	1.54	22	91	9.3	106.8	106.8	106.9	0.1
U	1.56	8	68	12.5	112.2	112.2	112.2	0.0
V	1.61	43	283	2.9	114.2	114.2	115.1	0.9
W	1.74	27	81	9.9	120.9	120.9	120.9	0.0
X	1.83	38	170	4.8	125.0	125.0	125.7	0.7
Y	1.96	52	101	8.0	135.8	135.8	135.8	0.0
Z	2.02	42	130	6.3	140.4	140.4	140.5	0.1

[1] Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

MAY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
May Creek (Cont'd)								
AA	3.23	37	124	5.1	266.4	266.4	267.3	0.9
AB	3.34	33	78	8.2	278.3	278.3	278.3	0.0
AC	3.49	41	135	4.7	289.6	289.6	290.2	0.6
AD	3.68	40	134	4.8	300.3	300.3	300.3	0.0
AE	3.74	15	78	8.2	304.3	304.3	304.5	0.2
AF	3.80	21	80	8.0	306.5	306.5	306.9	0.4
AG	3.90	18	105	5.3	309.2	309.2	310.0	0.8
AH	3.99	53	257	2.2	310.0	310.0	310.7	0.7
AI	4.07	19	92	5.5	310.2	310.2	311.1	0.9
AJ	4.13	92	371	1.4	311.5	311.5	312.1	0.6
AK	4.22	75	303	1.7	311.5	311.5	312.3	0.8
AL	4.37	231	983	0.5	311.8	311.8	312.8	1.0
AM	4.48	96	387	1.3	311.9	311.9	312.9	1.0
AN	4.58	137	540	0.9	312.1	312.1	313.1	1.0
AO	4.68	19	78	6.5	312.5	312.5	313.1	0.6
AP	4.90	133	559	0.9	313.4	313.4	314.4	1.0
AQ	5.12	115	325	1.6	313.8	313.8	314.8	1.0
AR	5.30	44	120	4.2	315.5	315.5	316.0	0.5
AS	5.47	12	57	6.5	319.2	319.2	319.2	0.0
AT	5.56	73	413	0.9	320.3	320.3	321.1	0.8
AU	5.72	85	444	0.8	320.3	320.3	321.2	0.9
AV	5.86	184	743	0.5	320.4	320.4	321.4	1.0
AW	6.00	216	491	0.8	320.4	320.4	321.4	1.0
AX	6.16	50	70	5.3	321.9	321.9	322.2	0.3
AY	6.29	100	271	1.4	323.2	323.2	324.2	1.0
AZ	6.44	170	324	1.1	324.0	324.0	324.8	0.8

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MAY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
May Creek (Cont'd)								
BA	6.56	13	40	6.0	324.3	324.3	325.3	1.0
BB	6.65	138	106	2.3	329.5	329.5	329.5	0.0
BC	6.70	11	26	4.3	330.8	330.8	331.4	0.6
BD	6.78	34	58	1.9	332.0	332.0	332.8	0.8
BE	6.93	61	48	2.3	334.1	334.1	335.1	1.0
BF	7.10	33	37	2.9	338.1	338.1	338.8	0.7
BG	7.24	11	26	4.2	341.9	341.9	342.7	0.8

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MAY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[2] FLOODWAY (FEET NGVD)	WITH[2] FLOODWAY (FEET NGVD)	INCREASE
May Creek Tributary								
A	700	61	127	1.1	329.5	328.0	329.0	1.0
B	1,100	78	198	0.7	329.5	328.1	329.1	1.0
C	1,600	69	151	0.3	329.5	328.2	329.2	1.0
D	1,950	45	92	0.5	329.5	328.2	329.2	1.0
E	2,420	51	96	0.5	329.5	328.3	329.3	1.0
F	2,760	13	22	2.1	329.5	328.5	329.4	0.9

[1]Feet Above Mouth
[2]Elevations Computed Without Consideration of Backwater from May Creek

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

TABLE 4

FLOODWAY DATA

MAY CREEK TRIBUTARY

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY FEET (NGVD)	WITH FLOODWAY FEET (NGVD)	INCREASE
MIDDLE FORK SNOQUALMIE RIVER								
A-AG[2]								
AH	43.22	450	7,992	4.8	424.9	424.9	425.9	1.0
AI	43.69	2,162	29,756	1.3	426.0	426.0	427.0	1.0
AJ	44.05	2,900	27,113	1.4	426.2	426.2	427.2	1.0
AK	44.27	3,171	16,806	2.3	426.3	426.3	427.2	0.9
AL	44.51	3,205	19,507	2.0	427.1	427.1	428.1	1.0
AM	44.69	2,970	15,882	2.3	428.1	428.1	428.8	0.7
AN	44.95	924	5,066	7.3	434.4	434.4	435.2	0.8
AO	45.16	649	5,173	7.2	438.9	438.9	439.2	0.3
AP	45.40	803	6,072	6.1	442.9	442.9	443.6	0.7
AQ	45.66	457	3,697	10.1	449.7	449.7	449.8	0.1
AR	45.90	361	3,461	11.4	455.1	455.1	455.4	0.3
AS	46.12	984	7,132	5.5	461.0	461.0	461.4	0.4
AT	46.36	610	3,432	12.8	467.1	467.1	467.1	0.0
AU	46.64	600	3,716	11.8	477.8	477.8	477.8	0.0
AV	47.76	648	4,608	9.5	481.2	481.2	482.1	0.9
AW	47.80	442	3,997	11.0	482.3	482.3	483.3	1.0
AX	47.93	491	5,319	8.2	486.5	486.5	487.5	1.0
AY	48.04	281	3,216	13.6	489.0	489.0	489.7	0.7
AZ	48.15	411	4,792	9.1	493.9	493.9	494.8	0.9
BA	48.31	378	3,903	11.2	498.2	498.2	498.5	0.3
BB	48.45	732	5,608	7.8	503.3	503.3	503.7	0.4
BC	48.58	794	5,883	7.4	506.5	506.5	506.8	0.3
BD	48.71	507	4,052	10.8	510.3	510.3	510.4	0.1
DE	48.83	637	4,813	9.1	515.3	515.3	515.4	0.1
BF	48.95	676	5,576	7.9	518.7	518.7	519.3	0.6

[1] Stream distance in miles above mouth.
[2] Cross sections A-AG reserved for Snoqualmie River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE FORK SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Middle Fork Snoqualmie River (continued)								
BG	49.07	725	5,030	8.7	521.5	521.5	522.4	0.9
BH	49.18	234	2,781	15.8	524.9	524.9	525.8	0.9
BI	49.31	274	3,655	12.0	532.2	532.2	532.5	0.3
BJ	49.44	295	3,720	11.8	536.1	536.1	536.3	0.2
BK	49.56	350	3,140	13.9	540.9	540.9	540.9	0.0
BL	49.65	225	2,638	16.6	546.3	546.3	546.3	0.0
BM	49.77	238	3,257	13.4	553.0	553.0	553.1	0.1
BN	49.87	278	3,592	12.2	556.2	556.2	556.6	0.4
BO	50.00	316	2,850	15.4	562.7	562.7	562.9	0.2
BP	50.12	251	3,612	12.1	568.2	568.2	569.1	0.9
BQ	50.26	216	3,171	13.8	572.1	572.1	572.7	0.6
BR	50.38	175	2,938	14.9	576.1	576.1	576.3	0.2
BS	50.62	351	3,508	12.5	585.6	585.6	586.5	0.9
BT	50.80	321	2,732	16.0	596.3	596.3	596.3	0.0
BU	51.03	202	2,790	15.7	610.9	610.9	611.0	0.1
BV	51.32	194	2,255	19.4	628.8	628.8	628.8	0.0

[1] Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE FORK SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET (NGVD))	WITH FLOODWAY (FEET (NGVD))	INCREASE
MIDDLE OVERFLOW								
A	1,000	87	372	2.4	431.1	431.1	431.5	0.4
B	1,575	135	273	2.9	432.7	432.7	432.7	0.0
C	1,975	129	215	4.0	433.9	433.9	433.9	0.0
D	2,924	206	743	1.2	436.8	436.8	437.2	0.4
E	3,675	292	298	3.0	439.5	439.5	439.5	0.0
F	4,125	100	294	3.1	441.1	441.1	441.2	0.1

[1] Stream distance in feet above convergence with South Fork Snoqualmie River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MIDDLE OVERFLOW

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[3] FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Mill Creek-Auburn								
A	240	--[2]	--[2]	--[2]	41.9	30.0	--[2]	--[2]
B	960	--[2]	--[2]	--[2]	41.9	30.3	--[2]	--[2]
C	1,490	--[2]	--[2]	--[2]	41.9	32.9	--[2]	--[2]
D	1,518	--[2]	--[2]	--[2]	41.9	33.0	--[2]	--[2]
E	1,720	--[2]	--[2]	--[2]	41.9	34.2	--[2]	--[2]
F	2,140	--[2]	--[2]	--[2]	41.9	34.9	--[2]	--[2]
G	2,305	--[2]	--[2]	--[2]	41.9	35.0	--[2]	--[2]
H	2,460	--[2]	--[2]	--[2]	41.9	35.4	--[2]	--[2]
I	3,140	--[2]	--[2]	--[2]	41.9	35.9	--[2]	--[2]
J	4,060	--[2]	--[2]	--[2]	41.9	36.6	--[2]	--[2]
K	4,770	--[2]	--[2]	--[2]	41.9	37.8	--[2]	--[2]
L	5,450	--[2]	--[2]	--[2]	41.9	38.3	--[2]	--[2]
M	5,630	--[2]	--[2]	--[2]	41.9	38.4	--[2]	--[2]
N	5,810	--[2]	--[2]	--[2]	41.9	39.0	--[2]	--[2]
O	6,600	--[2]	--[2]	--[2]	41.9	39.3	--[2]	--[2]
P	7,460	--[2]	--[2]	--[2]	41.9	39.3	--[2]	--[2]
Q	7,860	--[2]	--[2]	--[2]	41.9	40.0	--[2]	--[2]
R	7,990	--[2]	--[2]	--[2]	41.9	40.1	--[2]	--[2]
S	8,500	--[2]	--[2]	--[2]	41.9	40.3	--[2]	--[2]
T	8,750	--[2]	--[2]	--[2]	41.9	40.4	--[2]	--[2]
U	8,960	--[2]	--[2]	--[2]	41.9	40.8	--[2]	--[2]
V	9,420	--[2]	--[2]	--[2]	41.9	41.1	--[2]	--[2]
W	9,840	--[2]	--[2]	--[2]	41.9	41.1	--[2]	--[2]
X	10,340	--[2]	--[2]	--[2]	41.9	41.1	--[2]	--[2]
Y	10,580	--[2]	--[2]	--[2]	41.9	41.1	--[2]	--[2]

[1]Feet Above Mouth [2]Storage Floodway [3]Elevation Computed Without Consideration of Backwater From Green River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK-AUBURN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[3] FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Mill Creek-Auburn (Cont'd)								
Z	10,760	--2	--2	--2	41.9	41.3	--2	--2
AA	10,090	--2	--2	--2	41.9	41.3	--2	--2
AB	11,070	--2	--2	--2	41.9	41.7	--2	--2
AC	11,580	--2	--2	--2	41.9	41.8	--2	--2
AD	12,210	52	267	1.8	42.3	42.3	42.6	0.3
AE	12,860	70	341	1.4	42.4	42.4	42.7	0.3
AF	13,590	35	165	2.9	42.6	42.6	43.0	0.4
AG	14,420	44	125	3.8	43.1	43.1	43.8	0.7
AH	14,766	17	71	5.6	44.1	44.1	44.6	0.5
AI	15,160	32	190	2.1	46.0	46.0	46.6	0.6
AJ	15,850	51	219	1.8	46.2	46.2	46.9	0.7
AK	17,050	44	168	2.4	46.7	46.7	47.3	0.6
AL	17,940	34	142	2.8	47.3	47.3	47.9	0.6
AM	18,190	15	83	4.3	47.5	47.5	48.1	0.6
AN	18,360	103	241	1.5	47.9	47.9	48.4	0.5
AO	19,220	98	195	1.8	48.5	48.5	49.1	0.6
AP	20,120	110	139	2.6	49.3	49.3	49.8	0.5
AQ	21,210	13	181	4.9	50.3	50.3	50.8	0.5
AR	21,630	260	67	0.6	50.4	50.4	50.9	0.5
AS	22,070	310	573	1.1	51.4	51.4	52.4	1.0
AT	22,680	310	312	0.7	52.2	52.2	52.6	0.4
AU	23,370	8	497	1.0	52.8	52.8	53.2	0.4
AV	23,760	220	325	6.9	53.0	53.0	53.5	0.5
AW	24,590	230	48	0.3	53.3	53.3	53.6	0.3
AX	25,450	250	1,127	0.4	56.4	56.4	57.4	1.0

[1]Feet Above Mouth [2]Storage Floodway [3]Elevation Computed Without Consideration of Backwater From Green River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK-AUBURN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Mill Creek-Auburn (Cont'd)								
AY	24,590	230	933	0.4	56.5	56.5	57.5	1.0
AZ	25,450	250	395	0.9	56.6	56.6	57.6	1.0
BA	25,680	215	251	1.5	56.9	56.9	57.6	0.8
BB	26,430	219	194	1.6	58.0	58.0	58.3	0.3
BC	27,250	135	221	1.4	58.7	58.7	59.1	0.4
BD	28,200	22	77	4.1	60.0	60.0	60.7	0.7
BE	29,000	40	114	2.8	61.7	61.7	62.1	0.4
BF	29,240	42	222	1.4	61.8	61.8	62.3	0.5
BG	29,512	38	223	1.4	61.8	61.8	62.3	0.5
BH	29,650	26	94	3.3	61.7	61.7	62.2	0.5
BI	30,480	56	95	3.3	62.3	62.3	62.7	0.4
BJ	31,310	33	109	2.9	62.7	62.7	63.0	0.3
BK	31,620	18	37	8.3	62.9	62.9	62.9	0.0
BL	31,747	6	30	10.4	63.7	63.7	63.7	0.0
BM	32,430	39	293	1.1	67.4	67.4	68.1	0.7

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK-AUBURN

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Mill Creek - Kent								
A	0.109	63	474	1.4	18.1	18.1	19.1	1.0
B	0.138	60	322	2.0	18.1	18.1	19.1	1.0
C	0.737	49	331	2.0	19.5	19.5	20.2	0.7
D	0.788	50	323	2.0	20.3	20.3	21.0	0.7
E	1.083	56	405	1.6	22.3	22.3	22.8	0.5
F	1.410	57	328	2.0	22.7	22.7	23.2	0.5
G	1.476	41	300	2.2	22.8	22.8	23.3	0.5
H	1.660	40	276	2.4	23.9	23.9	24.3	0.4
I	1.767	50	349	1.9	24.9	24.9	25.3	0.4
J	1.803	38	325	1.6	25.2	25.2	25.5	0.3
K	1.992	37	277	1.9	25.3	25.3	25.8	0.5
L	2.203	43	346	0.8	25.6	25.6	26.0	0.4
M	2.294	42	311	0.9	25.5	25.5	26.0	0.5
N	2.357	32	254	1.1	25.7	25.7	26.2	0.5
O	2.545	41	210	1.3	25.8	25.8	26.3	0.5
P	2.612	38	270	1.0	25.9	25.9	26.4	0.5
Q	2.679	22	137	2.0	26.0	26.0	26.5	0.5
R	2.922	50	232	1.2	26.4	26.4	26.8	0.4
S	2.953	34	185	1.5	26.4	26.4	26.9	0.5
T	3.048	45	248	1.1	26.7	26.7	27.2	0.5
U	3.188	37	238	1.2	28.0	28.0	28.5	0.5
V	3.230	29	222	1.2	28.3	28.3	28.8	0.5
W	3.683	29	107	1.2	28.5	28.5	29.1	0.6
X	3.910	56	116	1.1	28.8	28.8	29.4	0.6
Y	3.943	47	78	1.7	30.0	30.0	31.0	1.0
Z	4.066	30	97	1.3	30.4	30.4	31.3	0.9
AA	4.175	27	99	1.3	30.6	30.6	31.5	0.9

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MILL CREEK - KENT

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Mill Creek - Kent (Cont'd)								
AB	22,218	16	82	1.6	31.4	31.4	32.3	0.9
AC	22,258	12	47	2.8	31.4	31.4	32.3	0.9
AD	22,558	12	82	1.6	31.8	31.8	32.7	0.9
AE	22,668	19	95	1.4	31.9	31.9	32.8	0.9
AF	22,828	27	85	1.5	31.9	31.9	32.8	0.9
AG	23,147	9	53	2.3	33.7	33.7	34.6	0.9
AH	23,377	24	105	1.1	33.8	33.8	34.7	0.9
AI	23,547	25	77	1.5	33.8	33.8	34.7	0.9
AJ	23,620	8	49	2.4	34.5	34.5	35.4	0.9
AK	23,640	21	100	1.2	34.7	34.7	35.5	0.8
AL	23,740	18	99	1.2	34.7	34.7	35.5	0.8
AM	24,055	22	117	1.0	35.7	35.7	36.5	0.8
AN	24,230	12	80	1.5	36.1	36.1	36.8	0.7
AO	24,275	31	163	0.7	36.1	36.1	36.8	0.7
AP	24,675	27	129	0.9	36.1	36.1	36.8	0.7
AQ	24,995	22	120	1.0	36.2	36.2	36.9	0.7
AR	25,555	26	126	0.8	36.2	36.2	36.9	0.7
AS	25,995	24	106	1.5	36.2	36.2	36.9	0.7
AT	26,395	23	137	1.0	36.3	36.3	37.1	0.8
AU	26,497	25	120	1.2	36.7	36.7	37.4	0.7
AV	26,897	19	82	1.7	36.8	36.8	37.5	0.7
AW	27,257	39	65	2.1	37.0	37.0	37.8	0.8
AX	27,537	12	51	2.7	37.3	37.3	37.9	0.6
AY	28,312	11	40	3.5	40.7	40.7	41.3	0.6
AZ	28,382	11	44	3.2	41.1	41.1	41.7	0.6

[1]Feet Above Mouth

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

TABLE 4

FLOODWAY DATA

MILL CREEK - KENT

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Miller Creek								
A	40	31	140	4.8	9.0	6.4[3]	6.4[3]	0.0
B	518	171[2]	361	1.9	9.0	8.4[3]	8.5[3]	0.1
C	973	211	301	2.2	9.1	9.1	10.1	1.0
D	1,586	15	59	8.1	15.7	15.7	15.7	0.0
E	1,916	17	82	5.8	17.7	17.7	18.6	0.9
F	3,016	23	59	8.1	30.7	30.7	30.8	0.1
G	3,391	17	62	7.8	36.3	36.3	36.3	0.0
H	3,867	54	54	8.9	43.3	43.3	43.3	0.0
I	4,109	24	76	5.6	46.2	46.2	46.2	0.0
J	4,579	25	60	7.2	56.4	56.4	56.4	0.0
K	6,494	24	67	6.4	101.7	101.7	101.7	0.0
L	8,984	22	57	5.2	158.1	158.1	158.1	0.0
M	9,428	12	58	5.1	169.4	169.4	170.4	1.0
N	10,248	19	70	3.9	188.4	188.4	188.6	0.2
O	10,603	37	136	2.0	192.1	192.1	192.2	0.1
P	11,028	17	67	4.1	192.8	192.8	192.9	0.1
Q	11,869	22	72	7.4	197.6	197.6	197.6	0.0
R	12,572	14	61	4.5	204.0	204.0	204.0	0.0
S	12,759	76	111	2.5	206.6	206.6	206.7	0.1
T	13,314	13	78	2.7	212.1	212.1	212.5	0.4
U	13,434	12	69	3.1	212.8	212.8	213.0	0.2
V	13,960	16	32	6.6	214.5	214.5	215.0	0.5
W	14,861	19	48	4.4	223.7	223.7	224.4	0.7
X	15,461	18	47	4.5	229.8	229.8	230.0	0.2
Y	16,006	11	37	5.8	235.9	235.9	236.5	0.6
Z	16,202	42	169	1.2	247.4	247.4	247.4	0.0
AA	16,837	13	43	4.9	250.5	250.5	250.5	0.0
AB	17,415	28	70	3.0	260.8	260.8	260.8	0.0
AC	17,801	20	78	2.7	264.0	264.0	264.3	0.3
AD	18,062	13	59	3.6	265.2	265.2	265.7	0.5
AE	18,982	335	973	0.2	265.4	265.4	266.4	1.0

[1]Feet Above Puget Sound
[2]Computed Without Consideration of Walker Creek Floodway
[3]Floodway Computed Without Consideration of Backwater From Puget Sound

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

MILLER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
North Creek								
A	0	65	412	3.9	22.4	21.6[2]	21.6[2]	0.0
B	275	44	276	5.8	22.4	21.8[2]	21.8[2]	0.0
C	660	104	523	3.1	22.6/22.4/22.4[3]	22.7[2]	22.8[2]	0.1
D	1,160	213	816	2.0	22.9/22.5/23.1[3]	23.0[4]	23.4[4]	0.4
E	1,510	325	811	2.0	23.1/23.3/24.0[3]	23.2[4]	23.7[4]	0.5
F	2,020	328	862	1.9	23.3/24.1/24.8[3]	23.4[4]	24.1[4]	0.7
G	2,279	257	831	1.9	23.3/24.9/25.8[3]	23.4[4]	24.2[4]	0.8
H	2,939	378	1,148	1.4	23.7/25.9/26.4[3]	23.7[4]	24.6[4]	0.9
I	3,654	213	697	2.4	25.2/27.2/26.5[3]	23.9[4]	24.9[4]	1.0
J	4,117	137	490	2.9	30.1	30.1	30.1	0.0
K	4,502	254	468	3.1	30.6	30.6	30.6	0.0
L	4,977	46	256	5.6	31.3	31.3	31.3	0.0
M	5,332	88	344	4.2	32.5	32.5	32.5	0.0
N	5,552	76	343	4.2	33.3	33.3	33.3	0.0
O	6,070	109	459	3.1	35.0	35.0	35.0	0.0
P	6,869	540	2,769	0.5	35.4	35.4	35.4	0.0
Q	7,779	98	367	3.9	36.0	36.0	36.0	0.0
R	8,094	74	372	3.9	37.1	37.1	37.1	0.0
S	8,902	115	432	3.3	39.6	39.6	39.6	0.0

[1]Feet above Sammamish River [2]Elevations computed without consideration of backwater effects from Sammamish River [3]Landward of east levee/riverward of levees/landward of west levee [4]Elevations computed without consideration of effects of levees

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA AND INCORPORATED AREAS

FLOODWAY DATA

NORTH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET NGVD)
North Fork Issaquah Creek								
A	25	50	138	2.3	45.1	45.1	46.1	1.0
B	1,159	49	83	3.8	52.5	52.5	52.5	0.0
C	1,695	46	128	2.5	54.7	54.7	55.0	0.3
D	2,267	46	206	1.5	56.0	56.0	56.9	0.9
E	2,389	40	213	1.5	57.2	57.2	58.0	0.8
F	2,993	42	211	1.5	60.7	60.7	61.4	0.7
G	3,215	40	173	1.8	60.8	60.8	61.5	0.7
H	3,887	13	67	4.7	62.2	62.2	62.5	0.3
I	4,054	13	38	8.2	64.3	64.3	64.6	0.3
J	4,565	30	121	2.6	66.4	66.4	67.0	0.6
K	5,122	49	231	1.4	71.8	71.8	71.8	0.0
L	5,359	14	34	9.2	71.8	71.8	71.8	0.0
M	5,468	34	77	4.1	73.8	73.8	73.8	0.0
N	5,814	16	36	8.6	82.1	82.1	82.1	0.0
O	6,055	16	36	8.6	90.0	90.0	90.0	0.0

[1]Feet Above Confluence With Issaquah Creek

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET NGVD)
North Fork Snoqualmie River								
A	0.16	770	4,239	6.4	426.0	419.9[2]	420.9[2]	1.0
B	0.28	320	2,082	13.1	426.1	421.9[2]	422.5[2]	0.6
C	0.36	155	1,923	14.1	427.1	424.5[2]	425.1[2]	0.6
D	0.48	550	5,299	5.1	428.6	428.6	428.8	0.2
E	0.64	1,300	9,056	3.0	429.2	429.2	430.1	0.9
F	0.74	1,100	8,352	3.3	429.7	429.7	430.7	1.0
G	0.84	800	4,769	5.7	430.3	430.3	431.2	0.9
H	0.97	1,450	8,048	3.4	432.8	432.8	433.7	0.9
I	1.07	1,562	6,883	4.0	434.4	434.4	434.9	0.5
J	1.17	1,348	6,422	4.2	435.3	435.3	435.6	0.3
K	1.22	1,082	3,654	7.4	436.1	436.1	436.2	0.1
L	1.33	474	2,819	9.6	441.1	441.1	442.0	0.9
M	1.42	294	2,245	12.1	444.8	444.8	444.8	0.0
N	1.50	230	2,095	13.0	446.9	446.9	447.5	0.6
O	1.57	228	2,269	12.0	450.3	450.3	450.6	0.3
P	1.65	240	3,472	7.8	452.5	452.5	453.4	0.9
Q	1.72	202	1,664	16.3	455.2	455.2	455.2	0.0
R	1.78	280	2,734	10.0	458.9	458.9	459.6	0.7
S	1.86	295	2,344	11.6	460.9	460.9	461.6	0.7
T	1.93	234	1,987	13.7	463.2	463.2	463.7	0.5
U	2.01	227	1,944	14.0	466.5	466.5	466.8	0.3
V	2.10	268	2,442	11.1	470.3	470.3	471.2	0.9
W	2.16	267	2,280	11.9	472.6	472.6	472.9	0.3
X	2.24	164	1,598	17.0	474.7	474.7	474.7	0.0
Y	2.32	190	1,959	13.9	479.3	479.3	479.4	0.1
Z	2.42	147	1,524	17.9	482.6	482.6	482.4	0.2

[1]Miles above mouth [2]Elevations Computed Without Consideration of Backwater Effects from Middle Fork Snoqualmie River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
North Fork Thornton Creek								
Y	7,470	12	33	9.7	51.0	51.0	51.0	0.0
Z	7,801	15	36	8.8	55.7	55.7	55.7	0.0
AA	8,020	14	48	6.7	58.6	58.6	58.6	0.0
AB	8,550	16	40	7.0	63.1	63.1	63.1	0.0
AC	9,271	6	18	10.2	84.6	84.6	84.6	0.0
AD	9,406	14	59	3.0	89.7	89.7	89.7	0.0
AE	9,635	15	25	7.3	94.1	94.1	94.1	0.0
AF	9,840	24	37	4.8	96.3	96.3	96.4	0.1
AG	10,550	15	24	7.4	107.7	107.7	107.7	0.0
AH	11,328	5	17	10.5	127.9	127.9	127.9	0.0
AI	11,690	16	25	7.2	133.2	133.2	133.2	0.0
AJ	12,345	13	24	7.6	144.4	144.4	144.4	0.0
AK	13,035	4	16	11.1	163.2	163.2	163.2	0.0
AL	13,200	17	66	2.7	166.3	166.3	166.3	0.0
AM	13,672	4	14	10.7	172.6	172.6	172.6	0.0
AN	13,836	21	60	2.5	178.0	178.0	178.0	0.0
AO	14,570	24	25	5.9	187.5	187.5	187.5	0.0
AP	15,560	22	25	6.1	203.2	203.2	203.2	0.0
AQ	15,953	7	16	9.1	213.1	213.1	213.1	0.0
AR	16,095	11	27	5.5	216.8	216.8	216.8	0.0
AS	16,750	10	19	7.8	228.6	228.6	228.6	0.0
AT	17,190	7	14	7.9	233.9	233.9	233.9	0.0
AU	17,395	13	29	3.8	236.6	236.6	236.6	0.0
AV	17,555	10	21	5.4	237.1	237.1	237.1	0.0
AW	17,884	8	18	6.0	239.7	239.7	239.8	0.1
AX	18,045	40	70	1.6	241.1	241.1	241.2	0.1
AY	19,003	7	10	11.6	248.1	248.1	248.1	0.0
AZ	19,204	60	219	0.5	254.0	254.0	254.0	0.0

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK THORNTON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Raging River								
A	200	436	1,130	6.6	95.5	81.7[2]	82.7[2]	1.0
B	698	308	807	9.2	96.5	90.7[2]	91.7[2]	1.0
C	1,607	522	1,481	5.0	101.0/101.6/100.5[3]	98.9[4]	99.9[4]	1.0
D	2,183	476	1,075	6.9	104.2/104.4/102.1[3]	102.0[4]	103.0[4]	1.0
E	2,667	164	926	8.0	108.8/110.6/108.8[3]	108.8[4]	108.8[4]	0.0
F	3,000	242	835	8.9	111.0/111.1/111.4[3]	111.0[4]	111.0[4]	0.0
G	3,519	87	653	11.4	114.0/115.8/114.9[3]	113.8[4]	114.8[4]	1.0
H	3,935	116	693	10.7	118.5/118.8/118.1[3]	118.2[4]	118.7[4]	0.5
I	4,447	122	891	8.3	122.3/122.2/122.6[3]	122.3[4]	122.7[4]	0.4
J	5,117	135	695	10.7	127.7/127.9/127.9[3]	127.6[4]	127.9[4]	0.3
K	5,498	134	751	9.9	132.3/132.2/132.1[3]	132.2[4]	132.2[4]	0.0
L	5,868	95	571	13.0	135.9/135.9/136.0[3]	135.9[4]	135.9[4]	0.0
M	6,372	105	742	10.0	142.0/142.0/141.9[3]	141.9[4]	141.9[4]	0.0
N	6,824	92	576	12.9	146.8/146.8/146.7[3]	146.7[4]	146.7[4]	0.0
O	7,388	77	575	12.9	155.5/155.5/155.6[3]	155.5[4]	155.5[4]	0.0
P	7,720	97	623	11.9	159.9/159.9/159.9[3]	159.9[4]	159.9[4]	0.0
Q	8,246	98	700	10.6	166.3	166.3	166.6	0.3
R	8,746	86	592	12.5	171.6	171.6	171.6	0.0
S	9,301	86	595	12.5	178.4	178.4	179.3	0.9
T	9,804	283	1,616	4.6	183.4	183.4	184.4	1.0
U	10,373	133	641	11.6	189.4	189.4	189.5	0.1
V	10,697	113	657	11.3	193.0	193.0	193.9	0.9
W	11,106	122	1,332	5.6	204.0	204.0	204.4	0.4
X	11,594	97	648	11.4	205.9	205.9	206.1	0.2
Y	12,122	67	487	15.2	212.9	212.9	212.9	0.0
Z	12,723	140	858	8.6	223.3	223.3	223.3	0.0

[1]Feet Above Confluence With Snoqualmie River
[2]Elevations Computed Without Consideration of Influence from Snoqualmie River
[3]Landward of Left Levee/Riverward of Levees/Landward of Right Levee
[4]Elevations Computed Without Consideration of Levees

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

RAGING RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET NGVD)
Raging River (Cont'd)								
AA	13,162	81	516	14.4	230.6	230.6	230.6	0.0
AB	13,767	96	821	9.0	242.8	242.8	242.8	0.0
AC	14,171	123	620	12.0	248.2	248.2	248.3	0.1
AD	14,636	119	1,099	6.3	258.6	258.6	258.7	0.1
AE	15,177	96	658	10.6	261.9	261.9	262.2	0.3
AF	15,862	77	484	14.4	273.9	273.9	274.4	0.5
AG	16,532	90	663	10.5	285.9	285.9	286.9	1.0
AH	16,958	104	540	12.9	294.5	294.5	294.5	0.0
AI	17,808	177	747	9.3	313.4	313.4	313.5	0.1
AJ	18,647	95	650	10.7	326.1	326.1	326.1	0.0
AK	19,379	121	776	9.0	334.8	334.8	335.7	0.9
AL	20,267	84	595	11.7	346.4	346.4	347.4	1.0
AM	20,827	137	770	9.1	354.8	354.8	355.6	0.8
AN	21,506	97	631	11.0	363.2	363.2	364.2	1.0
AO	22,376	103	705	9.9	374.6	374.6	375.6	1.0
AP	23,127	185	907	7.7	381.7	381.7	382.7	1.0
AQ	23,828	101	683	10.2	393.8	393.8	393.8	0.0
AR	24,406	100	564	12.4	400.9	400.9	401.1	0.2
AS	24,950	115	639	10.9	412.0	412.0	412.4	0.4
AT	25,526	133	816	8.5	420.0	420.0	420.0	0.0
AU	25,983	79	471	12.7	425.4	425.4	425.4	0.0
AV	26,586	272	845	7.1	433.8	433.8	434.0	0.2
AW	27,197	150	666	9.0	440.8	440.8	441.1	0.3
AX	27,733	93	556	10.8	448.9	448.9	449.0	0.1
AY	28,479	168	789	7.6	459.1	459.1	459.5	0.4
AZ	28,950	87	459	13.1	467.6	467.6	467.6	0.0

[1]Feet Above Confluence With Snoqualmie River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

RAGING RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NGVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Raging River (Cont'd)								
BA	29,643	73	592	10.2	479.8	479.8	480.5	0.7
BB	30,343	137	586	10.3	489.6	489.6	490.5	0.9
BC	31,163	176	751	8.0	504.7	504.7	505.7	1.0
BD	31,933	291	730	8.2	514.1	514.1	515.0	0.9
BE	32,803	261	1,211	5.0	526.8	526.8	527.7	0.9
BF	33,643	162	656	9.2	536.1	536.1	536.2	0.1
BG	34,413	149	932	5.2	545.0	545.0	546.0	1.0
BH	35,233	123	470	10.4	554.9	554.9	554.9	0.0
BI	36,443	164	777	6.3	571.3	571.3	572.3	1.0
BJ	37,183	131	514	9.5	582.2	582.2	582.8	0.6
BK	38,043	78	592	8.2	595.3	595.3	595.8	0.5
BL	38,643	105	454	10.7	605.0	605.0	605.0	0.0
BM	39,273	101	522	9.3	614.9	614.9	615.6	0.7
BN	39,473	113	625	7.8	618.7	618.7	619.2	0.5
BO	39,583	96	618	7.9	620.1	620.1	620.7	0.6
BP	40,003	80	450	10.8	625.7	625.7	625.7	0.0
BQ	40,663	97	604	8.1	634.7	634.7	635.6	0.9
BR	41,083	117	383	8.9	642.1	642.1	642.2	0.1
BS	41,283	212	766	4.4	646.1	646.1	647.1	1.0
BT	41,348	216	987	3.5	647.2	647.2	647.8	0.6
BU	42,043	84	313	10.9	654.2	654.2	654.2	0.0
BV	42,493	58	394	8.6	663.3	663.3	664.2	0.9
BW	43,123	86	413	8.3	673.1	673.1	673.8	0.7

[1]Feet Above Confluence With Snoqualmie River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

RAGING RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Sammamish River								
A	0.25	80	803	4.8	15.0	15.0	15.0	0.0
B	1.10	45	1,007	3.5	17.5	17.5	17.5	0.0
C	1.30	45	954	3.7	18.2	18.2	18.2	0.0
D	1.78	128	1,081	3.2	19.1	19.1	19.2	0.1
E	2.44	132	1,214	2.9	20.2	20.2	20.2	0.0
F	2.79	130	1,253	2.6	20.7	20.7	20.7	0.0
G	3.52	144	1,303	2.7	21.5	21.5	21.5	0.0
H	3.92	138	1,196	2.9	22.0	22.0	22.0	0.0
I	4.90	85	1,179	2.7	23.1	23.1	23.1	0.0
J	5.50	50	1,093	2.9	23.8	23.8	23.8	0.0
K	6.05	50	1,068	2.8	24.4	24.4	24.4	0.0
L	6.30	40	1,111	2.7	24.8	24.8	24.8	0.0
M	7.00	40	1,041	2.9	25.6	25.6	25.6	0.0
N	7.35	55	1,144	2.6	26.0	26.0	26.0	0.0
O	7.70	45	1,159	2.6	26.4	26.4	26.4	0.0
P	8.30	40	1,141	2.6	27.0	27.0	27.0	0.0
Q	9.20	45	1,123	2.6	27.8	27.8	27.8	0.0
R	9.30	45	1,094	2.7	28.1	28.1	28.3	0.2
S	10.68	45	1,184	2.5	28.3	28.3	28.7	0.4
T	10.99	70	1,096	2.7	28.6	28.6	29.0	0.4
U	11.80	75	1,111	2.6	29.6	29.6	29.8	0.2
V	12.79	60	1,102	2.6	30.6	30.6	30.8	0.2
W	13.05	60	1,060	2.7	30.9	30.9	31.1	0.2
X	13.28	80	1,133	2.5	31.1	31.1	31.3	0.2
Y	13.70	60	1,196	1.9	31.6	31.6	31.8	0.2

[1]Miles Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SAMMAMISH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Sammamish River (Cont'd)								
Z	14.15	50	1,180	1.9	31.8	31.8	32.0	0.2
AA	14.35	180	2,472	0.9	32.0	32.0	32.1	0.1
AB	14.65	150	1,891	1.2	32.0	32.0	32.2	0.2
AC	14.95	120	1,977	1.3	32.2	32.2	32.4	0.2

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SAMMAMISH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Snoqualmie River								
A	6.50	4,762	48,310	1.8	43.0	43.0	43.8	0.8
B	9.80	3,273	25,877	3.4	44.7	44.7	45.5	0.8
C	11.40	3,366	28,797	2.3	46.4	46.4	47.3	0.9
D	14.70	2,646	16,553	3.1	49.4	49.4	50.2	0.8
E	16.65	3,151	27,176	2.5	51.5	51.5	52.4	0.9
F	18.80	4,453	26,323	3.7	54.0	54.0	54.9	0.9
G	19.90	3,014	25,071	2.8	55.2	55.2	56.1	0.9
H	21.15	1,467	20,888	2.5	56.0	56.0	57.0	1.0
I	24.30	1,044	11,930	4.8	68.6	68.6	69.2	0.6
J	25.10	1,577	18,355	3.7	74.7	74.7	75.1	0.4
K	26.90	4,678	55,633	3.1	77.1	77.1	77.7	0.6
L	28.55	4,330	44,702	1.9	77.7	77.7	78.3	0.6
M	30.70	4,451	35,057	2.7	79.5	79.5	80.2	0.7
N	33.10	3,581	27,294	2.7	82.0	82.0	82.9	0.9
O	35.10	3,025	24,466	3.2	88.2	88.2	89.1	0.9
P	36.20	1,498	16,200	3.1	94.3	94.3	95.3	1.0
Q	36.80	1,564	17,259	4.7	99.0	99.0	99.7	0.7
R	38.60	415	7,007	4.3	108.5	108.5	108.9	0.4
S	40.00	320	3,795	15.5	126.1	126.1	126.1	0.0
T	40.42	283	4,593	17.4	413.0	413.0	413.0	0.0
U	40.66	568	9,384	8.5	419.3	419.3	419.3	0.0
V	40.72	890	13,024	6.1	420.0	420.0	420.0	0.0
W	40.94	1,618	17,979	4.4	421.2	421.2	421.2	0.0
X	41.19	2,340	16,674	4.8	421.9	421.9	421.9	0.0
Y	41.34	2,580	32,581	2.5	422.0	422.0	422.8	0.8

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY FEET (NGVD)	WITH FLOODWAY FEET (NGVD)	INCREASE
Snoqualmie River								
Z	41.68	4,430	55,281	1.4	422.4	422.4	422.4	0.0
AA	42.00	5,110	60,389	1.3	422.7	422.7	423.7	1.0
AB	42.19	5,356	49,249	1.6	422.9	422.9	423.9	1.0
AC	42.51	4,529	44,191	1.8	423.4	423.4	424.4	1.0
AD	42.80	4,120	53,662	1.5	423.7	423.7	424.7	1.0
AE	43.06	3,900	18,226	2.7	423.9	423.9	424.7	0.8
AF	43.39	3,330	47,273	1.7	424.5	424.5	425.5	1.0
AG	43.67	3,330	40,111	2.0	424.8	424.8	425.8	1.0

[1] Miles above mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
South Fork Skykomish River								
A	56.34	1,803	13,122	5.4	750.9	750.9	751.4	0.5
B	56.56	1,604	11,789	6.0	753.1	753.1	753.7	0.6
C	56.77	1,825	15,350	4.6	756.0	756.0	756.8	0.8
D	56.97	545	6,845	10.4	758.4	758.4	758.9	0.5
E	57.21	570	6,632	10.8	762.6	762.6	763.1	0.5
F	57.38	461	5,835	12.2	765.6	765.6	766.6	1.0
G	57.46	364	5,039	14.2	768.4	768.4	768.8	0.4
H	57.67	467	6,544	10.9	774.0	774.0	774.1	0.1
I	57.92	820	6,637	10.7	778.4	778.4	778.5	0.1
J	58.14	1,070	8,834	8.1	783.2	783.2	783.7	0.5
K	58.32	1,140	8,266	8.6	785.1	785.1	786.1	1.0
L	58.52	715	6,726	10.6	787.9	787.9	788.1	0.2
M	58.73	785	7,241	9.8	791.4	791.4	792.4	1.0
N	58.91	800	7,371	9.7	795.7	795.7	795.7	0.0
O	59.13	865	9,467	7.5	800.6	800.6	801.5	0.9
P	59.27	274	3,979	17.9	802.1	802.1	802.8	0.7
Q	59.48	671	8,695	8.2	809.9	809.9	810.3	0.4
R	59.70	850	7,912	9.0	812.8	812.8	813.2	0.4
S	59.94	490	6,100	11.7	818.0	818.0	818.3	0.3
T	60.11	561	6,310	11.3	820.9	820.9	821.9	1.0
U	60.32	658	8,163	8.7	826.3	826.3	826.7	0.4
V	60.53	950	12,476	5.7	829.9	829.9	830.5	0.6
W	60.74	990	8,560	8.3	831.0	831.0	832.0	1.0
X	60.95	1,270	12,060	5.9	834.5	834.5	835.5	1.0
Y	61.18	1,255	10,668	6.7	837.2	837.2	838.2	1.0

[1] Miles above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK SKYKOMISH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
South Fork Skykomish River (continued)								
Z	61.57	1,123	9,203	7.7	843.4	843.4	844.4	1.0
AA	61.79	969	6,569	10.9	849.5	849.5	850.3	0.8
AB	62.13	430	6,322	11.3	857.9	857.9	858.6	0.7
AC	62.26	316	5,116	13.9	862.9	862.9	862.9	0.0
AD	62.35	257	4,790	14.9	865.3	865.3	865.3	0.0
AE	62.46	177	3,665	19.5	866.9	866.9	866.9	0.0
AF	62.64	700	10,071	7.1	873.7	873.7	874.5	0.8
AG	62.84	500	7,261	9.8	875.2	875.2	875.8	0.6
AH	63.02	700	7,393	9.6	878.2	878.2	879.1	0.9
AI	63.39	782	9,229	7.7	885.9	885.9	886.9	1.0
AJ	63.72	734	7,527	7.2	891.3	891.3	892.3	1.0
AK	63.99	323	4,637	11.7	895.0	895.0	895.8	0.8
AL	64.18	277	4,195	12.9	900.6	900.6	900.6	0.0
AM	64.36	291	4,277	12.7	903.6	903.6	904.0	0.4
AN	64.53	723	7,671	7.1	907.2	907.2	907.7	0.5
AO	64.82	283	3,442	15.8	911.4	911.4	911.4	0.0
AP	65.11	620	7,936	6.8	920.2	920.2	920.8	0.6
AQ	65.35	637	7,145	7.6	922.8	922.8	923.7	0.9
AR	65.45	600	6,476	8.4	924.5	924.5	925.0	0.5
AS	65.49	560	5,299	10.2	925.2	925.2	925.7	0.5
AT	65.55	548	4,576	11.9	925.4	925.4	926.4	1.0
AU	65.61	195	2,567	21.2	926.3	926.3	926.3	0.0
AV	65.69	455	6,738	8.1	933.9	933.9	933.9	0.0
AW	65.82	351	4,327	12.5	934.5	934.5	934.5	0.0

[1] Miles above Mouth

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK SKYKOMISH RIVER

TABLE 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE [1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
South Fork Skykomish River (continued)								
AX	65.95	289	3,660	14.8	936.5	936.5	937.4	0.9
AY	66.05	570	4,577	11.9	939.8	939.8	939.8	0.0
AZ	66.28	619	3,952	13.7	946.1	946.1	946.1	0.0
BA	66.49	374	4,132	13.1	951.8	951.8	952.7	0.9
BB	66.61	265	5,133	10.6	960.1	960.1	960.1	0.0
BC	66.72	600	8,065	2.8	962.0	962.0	962.0	0.0
BD	66.90	1,354	7,601	3.0	962.3	962.3	962.4	0.1
BE	67.18	790	4,099	5.6	965.1	965.1	965.7	0.6
BF	67.39	233	2,363	9.6	969.0	969.0	969.7	0.7
BG	67.61	128	1,275	17.9	976.3	976.3	976.3	0.0
BH	67.89	330	2,989	7.6	988.8	988.8	988.9	0.1
BI	68.05	330	3,227	7.1	992.4	992.4	992.4	0.0
BJ	68.18	360	2,319	9.8	994.9	994.9	995.5	0.6
BK	68.34	202	1,752	13.0	1000.2	1000.2	1000.3	0.1
BL	68.59	154	1,821	12.5	1010.5	1010.5	1010.5	0.0
BM	68.80	159	1,360	16.8	1019.7	1019.7	1019.7	0.0
BN	69.08	114	1,245	18.3	1039.1	1039.1	1039.6	0.5

[1] Miles above Mouth

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK SKYKOMISH RIVER

TABLE 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
SOUTH FORK SNOQUALMIE RIVER								
A	9,400	1,681	9,892	2.0	431.0 /431.0/ 431.0[2]	431.0[3]	431.5[3]	0.5
B	12,378	166	1,615	9.3	436.8 /437.1/ 437.0[2]	436.8[3]	436.8[3]	0.0
C	14,432	862	4,541	3.3	441.5 /442.5/ 441.7[2]	441.3[3]	441.7[3]	0.4
D	14,768	721	3,772	4.0	442.0 /444.2/ 442.8[2]	441.6[3]	442.1[3]	0.5
E	16,540	220	2,257	6.6	447.1 /448.5/ 448.5[2]	446.7[3]	447.5[3]	0.8
F	16,960	319	2,151	7.0	447.5 /448.7/ 448.7[2]	447.2[3]	448.0[3]	0.8
G	17,775	860	6,143	2.4	449.2 /449.6/ 449.5[2]	449.0[3]	449.8[3]	0.8
H	18,592	421	2,361	6.4	449.7 /449.9/ 449.8[2]	449.7[3]	450.2[3]	0.5
I	19,180	315	2,735	5.5	451.3 /451.8/ 451.7[2]	451.3[3]	451.7[3]	0.4
J	19,545	307	2,162	6.9	451.9 /452.3/ 452.2[2]	451.9[3]	452.2[3]	0.3
K	20,250	304	2,053	7.3	453.9 /454.2/ 454.2[2]	453.9[3]	454.2[3]	0.3
L	21,220	607	2,076	7.2	456.4 /457.5/ 457.5[2]	456.4[3]	457.3[3]	0.9
M	21,905	985	4,684	3.2	459.1 /460.1/ 459.7[2]	458.8[3]	459.7[3]	0.9
N	23,415	836	3,483	4.3	463.2 /464.0/ 461.5[2]	461.4[3]	462.4[3]	1.0
O	24,088	557	2,380	6.3	465.3 /466.0/ 464.2[2]	464.1[3]	464.5[3]	0.4
P	24,597	388	1,835	8.2	467.1 /467.4/ 465.7[2]	465.7[3]	466.5[3]	0.8
Q	25,613	143	1,587	9.5	472.8 /473.0/ 473.0[2]	472.8[3]	473.1[3]	0.3
R	26,087	192	1,993	7.5	474.6 /474.8/ 474.8[2]	474.6[3]	474.6[3]	0.0
S	27,297	475	2,894	5.2	476.0/476.0/476.1[2]	476.26[3]	476.96	0.7
T	27,913	693	4,110	3.7	478.1/478.1/477.2[2]	477.26[3]	478.16	0.9
U	28,440	462	3,317	5.3	480.0/480.0/477.8[2]	477.86[3]	477.86	1.0
V	28,869	699	2,712	5.5	480.7/480.7/479.0[2]	479.06[3]	479.86	0.8
W	29,243	386	1,863	8.1	481.8/481.8/481.1[2]	481.16[3]	481.16	0.0
X	29,747	158	1,431	10.5	483.9/483.9/483.3[2]	483.36[3]	483.46	0.1
Y	30,763	119	1,247	12.0	487.0/480.7/486.5[2]	486.56[3]	486.96	0.4
Z	31,898	139	1,368	11.0	492.3/492.0/491.9[2]	491.96[3]	491.9	0.1

[1] Stream distance in feet above confluence with Snoqualmie River

[2] Landward of left levee/ Riverward of levees/ Landward of right levee

[3] Elevations computed without consideration of levees

Note: Reference to left and right are based on looking downstream direction

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET NGVD)
South Fork Snoqualmie River (With Levees) (Cont'd)								
AA	32,358	167	1,592	9.4	493.4/494.8/493.8[2]	493.8[3]	494.5	0.7
AB	32,737	162	1,389	10.8	494.2/494.4/495.2[2]	495.1[3]	496.0	0.9
AC	33,205	273	2,180	6.9	496.6/498.5/497.4[2]	498.5[3]	498.9	0.4
AD	33,741	310	2,439	6.2	498.5/499.4/499.1[2]	499.6[3]	500.3	0.7
AE	34,406	182	1,085	13.8	500.7/500.7/501.3[2]	500.7[3]	500.7	0.0
AF	34,784	335	2,167	6.9	505.9/505.9/505.6[2]	505.9[3]	505.9	0.0
AG	35,191	351	1,914	7.8	507.9/507.9/507.8[2]	507.9[3]	507.9	0.0
AH	35,682	152	1,242	12.1	511.3/511.3/511.3[2]	511.3[3]	511.3	0.0
AI	36,189	108	1,244	12.1	516.1/516.1/516.0[2]	516.0[3]	516.1	0.1
AJ	36,704	103	1,340	11.2	523.4/523.4/525.1[2]	523.4[3]	523.4	0.0
AK	37,291	143	1,393	10.8	527.4/527.4/524.2[2]	527.4[3]	527.4	0.0
AL	37,841	102	1,000	15.0	531.9/531.9/533.0[2]	531.9[3]	531.8	0.2
AM	38,443	155	1,591	9.4	538.5/538.5/538.1[2]	538.5[3]	539.0	1.0
AN	39,109	119	1,270	11.8	546.5	546.5[3]	546.5	0.0
AO	39,654	100	1,204	12.5	550.5	550.5[3]	550.5	0.0
AP	40,086	128	1,685	8.9	553.8	553.8	553.9	0.1
AQ	40,576	142	1,622	9.3	555.5	555.5	555.7	0.2
AR	41,027	182	1,397	10.7	557.7	557.7	557.8	0.1
AS	41,637	189	2,039	7.4	562.2	562.2	562.2	0.0
AT	42,231	121	1,246	12.0	564.1	564.1	564.1	0.0
AU	43,074	404	3,147	4.8	568.9	568.9	569.5	0.6
AV	43,631	382	2,726	5.5	570.3	570.3	571.0	0.7
AW	44,390	754	4,079	3.7	572.2	572.2	573.2	1.0
AX	44,968	561	2,869	5.2	573.6	573.6	574.5	0.1
AY	45,730	318	2,143	7.0	577.3	577.3	577.4	0.7
AZ	46,420	134	1,312	11.4	579.5	579.5	580.2	0.7

[1]Stream distance in feet above confluence with Snoqualmie River

[2]Landward of left levee/Riverward of levees/Landward of right

[3]Elevations computed without consideration of levees

Note: References to left and right are based on looking downstream direction

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Fork Snoqualmie River (With Levees) (Cont'd)								
BA	47,164	545	3,336	4.5	583.8	583.8	584.5	0.7
BB	48,308	1,350	8,269	1.8	590.3	590.3	590.7	0.4
BC	48,829	1,293	6,026	2.5	590.7	590.7	591.2	0.5
BD	49,371	113	923	16.3	592.2	592.2	592.2	0.0
BE	49,854	133	1,342	11.2	597.9	597.9	598.3	0.4
BF	50,445	235	1,658	9.0	602.4	602.4	602.4	0.0
BG	50,814	239	1,187	12.6	606.3	606.3	606.3	0.0
BH	51,203	203	1,898	7.9	611.2	611.2	611.4	0.2

[1]Stream distance in feet above confluence with Snoqualmie River

[2]Landward of left levee/Riverward of levees/Landward of right levee

[3]Elevations computed without consideration of levees

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK SNOQUALMIE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
South Fork Thornton Creek								
A	247	33	108	2.5	54.0	54.0	54.0	0.0
B	872	17	33	8.1	57.5	57.5	57.5	0.0
C	1,515	15	30	9.0	63.1	63.1	63.1	0.0
D	1,705	14	53	5.1	68.7	68.7	68.7	0.0
E	1,848	12	29	8.5	68.9	68.9	68.9	0.0
F	2,551	11	28	8.9	79.5	79.5	79.5	0.0
G	2,696	12	33	7.5	83.0	83.0	83.0	0.0
H	3,350	18	32	7.6	94.0	94.0	94.0	0.0
I	3,800	16	30	7.9	101.7	101.7	101.7	0.0
J	4,140	28	36	6.6	110.1	110.1	110.1	0.0
K	4,318	5	20	11.4	120.0	120.0	120.0	0.0
L	4,630	25	49	4.3	125.0	125.0	125.0	0.0
M	5,155	45	40	5.3	134.7	134.7	134.7	0.0
N	5,814	10	33	4.8	147.5	147.5	147.5	0.0
O	6,555	29	30	5.3	156.5	156.5	156.5	0.0
P	7,035	13	28	5.6	162.1	162.1	162.2	0.1
Q	7,520	13	21	7.2	169.7	169.7	169.7	0.0
R	7,788	9	15	9.7	183.1	183.1	183.1	0.0
S	8,035	19	24	6.4	191.6	191.6	191.6	0.0
T	9,359	6	16	9.3	221.4	221.4	221.4	0.0
U	9,600	49	47	3.2	224.1	224.1	224.1	0.0
V	9,915	10	19	7.9	227.9	227.9	227.9	0.0
W	10,274	17	40	3.8	230.1	230.1	230.1	0.0
X	10,457	12	49	1.8	232.7	232.7	232.8	0.1
Y	10,557	5	15	6.0	233.2	233.2	233.2	0.0
Z	10,890	10	16	5.5	236.2	236.2	236.2	0.0
AA	11,295	6	11	8.0	242.2	242.2	242.2	0.0

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SOUTH FORK THORNTON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Springbrook Creek								
A	0.00	74	342	3.2	15.0	6.5	7.5	1.0
B	0.07	26	173	6.4	15.0	7.0	7.6	0.6
C	0.16	76	436	2.5	15.0	7.8	8.7	0.9
D	0.17	67	380	2.9	15.0	7.8	8.8	1.0
E	0.32	37	168	6.6	15.0	8.7	9.1	0.4
F	0.41	48	274	4.0	15.0	10.0	11.0	1.0
G	0.49	11	100	11.0	15.0	11.4	12.4	1.0
H	0.55	25	331	3.3	16.4	15.5	15.9	0.4
I	0.57	39	440	2.5	16.4	15.5	16.1	0.6
J	0.59	59	576	1.9	16.4	15.6	16.2	0.6
K	0.63	28	346	3.2	16.4	15.6	16.2	0.6
L	0.67	24	270	4.1	16.4	15.6	16.2	0.6
M	1.25	50	439	2.9	15.8	15.8	16.3	0.5
N	1.49	83	638	2.0	16.0	16.0	16.6	0.6
O	1.62	25	297	4.0	16.0	16.0	16.7	0.7
P	1.99	63	581	2.1	16.6	16.6	17.4	0.8
Q	2.57	44	325	3.8	17.0	17.0	17.9	0.9
R	2.61	43	383	3.2	17.3	17.3	18.2	0.9
S	2.67	56	476	2.6	17.4	17.4	18.3	0.9
T	2.76	88	881	1.4	17.6	17.6	18.5	0.9
U	3.03	80	477	2.6	17.8	17.8	18.8	1.0
V	3.17	70	561	1.2	18.0	18.0	19.0	1.0
W	3.49	75	520	1.3	18.2	18.2	19.2	1.0
X	3.80	88	453	1.5	18.6	18.6	19.6	1.0
Y	3.95	59	328	2.0	19.2	19.2	20.2	1.0

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SPRINGBROOK CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Springbrook Creek								
Z	4.08	100	733	0.9	23.0	23.0	24.0	1.0
AA	4.29	50	316	2.1	23.2	23.2	24.1	0.9
AB	4.33	92	739	0.9	23.3	23.3	23.5	0.2
AC	4.51	30	303	1.7	23.4	23.4	23.6	0.2
AD	4.63	33	238	2.1	23.5	23.5	23.8	0.3
AE	4.82	29	218	2.3	23.7	23.7	24.0	0.3
AF	4.97	21	141	3.5	24.0	24.0	24.5	0.5
AG	5.13	28	211	2.4	24.6	24.6	25.2	0.6
AH	5.16	20	161	3.1	24.6	24.6	25.3	0.7
AI	5.36	30	202	2.5	25.4	25.4	26.1	0.7
AJ	5.53	19	147	3.4	26.2	26.2	26.8	0.6
AK	5.57	24	174	0.7	26.5	26.5	27.1	0.6
AL	5.65	30	187	0.6	26.5	26.5	27.1	0.6
AM	5.80	28	122	0.9	26.5	26.5	27.2	0.7
AN	5.94	28	87	1.3	26.7	26.7	27.3	0.6
AO	6.07	19	59	2.0	27.3	27.3	27.7	0.4
AP	6.18	25	75	1.4	27.9	27.9	28.3	0.4
AQ	6.21	34	96	1.1	28.3	28.3	28.7	0.4
AR	6.36	28	60	1.8	28.6	28.6	29.0	0.4
AS	6.38	30	69	1.4	29.0	29.7	29.7	0.7
AT	6.46	35	81	1.2	29.2	29.2	29.8	0.6
AU	6.58	23	92	0.8	30.0	30.0	30.8	0.8
AV	6.74	13	50	2.0	30.5	30.5	31.2	0.7
AW	6.85	25	99	1.0	30.8	30.8	31.4	0.6
AX	6.89	30	130	1.5	31.6	31.6	31.6	0.0
AY	7.18	30	78	3.8	33.2	33.2	33.2	0.0

[1] Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SPRINGBROOK CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY[2]	WITHOUT[3] FLOODWAY (FEET NGVD)	WITH[3] FLOODWAY (FEET NGVD)	INCREASE
Swamp Creek								
A	960	50	232	3.9	17.5	16.2	16.2	0.0
B	1,400	47	240	3.8	17.5	17.0	17.0	0.0
C	1,870	147	652	1.4	21.4	21.4	22.4	1.0
D	2,300	45	294	3.1	21.6	21.6	22.6	1.0
E	2,491	84	374	2.4	22.4	22.4	23.2	0.8
F	2,791	26	191	4.8	22.7	22.7	23.3	0.6
G	3,271	28	214	4.3	23.5	23.5	24.4	0.9
H	3,860	54	283	3.2	24.7	24.7	25.6	0.9
I	4,461	413	1,330	0.7	25.3	25.3	26.3	1.0
J	5,151	302	419	2.1	26.9	26.1	27.1	1.0
K	5,661	530	834	1.0	30.4	28.3	29.3	1.0
L	6,271	286	275	3.2	32.0	31.0	31.9	0.9
M	6,961	467	865	1.0	36.1	34.4	35.4	1.0
N	7,561	37	95	9.1	40.3	39.5	39.5	0.0
O	7,941	59	223	3.9	42.4	42.7	43.6	0.9
P	8,141	47	192	4.5	44.3	44.3	44.9	0.6
Q	8,181	66	186	4.7	44.7	44.7	45.0	0.3
R	8,931	242	397	2.2	49.7	49.7	50.1	0.4
S	9,631	33	93	9.4	52.9	52.9	53.0	0.1
T	9,961	295	351	2.5	57.0	57.0	57.9	0.9
U	10,231	75	143	6.1	59.1	59.1	59.6	0.5
V	10,791	48	172	5.1	64.3	64.3	65.3	1.0
W	11,381	55	144	6.0	71.4	71.4	71.4	0.0
X	12,031	28	176	4.9	75.3	75.3	76.2	0.9
Y	12,791	57	169	5.1	80.4	80.4	80.7	0.3

[1]Feet Above Mouth [2]Elevations Computed for Flow Confined to Main Channel Between Sections I and N

[3]Elevations Computed Without Consideration of Backwater from Sammamish River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

SWAMP CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT[2] FLOODWAY (FEET NGVD)	WITH[2] FLOODWAY (FEET NGVD)	INCREASE
Thornton Creek								
A	327	22	76	5.1	15.5	15.5	15.5	0.0
B	860	31	109	3.6	20.0	20.0	20.1	0.1
C	1,046	13	63	5.3	20.5	20.5	20.6	0.1
D	1,295	43	158	2.1	22.7	22.7	22.9	0.2
E	1,410	46	167	2.0	22.8	22.8	23.0	0.2
F	1,745	24	186	1.8	31.0	31.0	31.0	0.0
G	1,960	28	86	1.8	31.0	31.0	31.0	0.0
H	2,090	17	143	2.3	32.7	32.7	32.7	0.0
I	2,460	17	118	2.8	32.7	32.7	32.7	0.0
J	2,778	43	172	1.8	32.8	32.8	33.0	0.2
K	2,860	41	159	2.0	32.8	32.8	33.0	0.2
L	3,395	18	67	4.7	33.7	33.7	33.8	0.1
M	3,850	15	73	4.2	35.0	35.0	35.2	0.2
N	4,170	34	99	2.9	35.5	35.5	35.8	0.3
O	4,990	21	48	6.0	37.7	37.7	37.7	0.0
P	5,275	16	44	6.5	39.9	39.9	39.9	0.0
Q	5,488	22	72	4.1	40.9	40.9	41.8	0.9
R	5,606	18	73	3.6	41.7	41.7	42.5	0.8
S	5,888	28	82	3.2	43.1	43.1	43.6	0.5
T	6,046	20	68	3.8	43.6	43.6	44.0	0.4
U	6,460	16	68	3.7	44.3	44.3	44.6	0.3
V	6,570	63	404	0.6	47.3	47.3	47.3	0.0
W	6,800	35	178	3.3	47.3	47.3	47.3	0.0
X	7,155	31	143	4.1	49.7	49.7	49.9	0.2

[1]Feet Above Mouth

[2]Elevation Computed Without Consideration of Backwater Effects From Lake Washington

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

THORNTON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET (NAVD))	WITH FLOODWAY (FEET (NAVD))	INCREASE
Tibbets Creek								
A	0.15	N/A	N/A	N/A	32.1	32.1	N/A	N/A
B	0.29	23	88	5.4	32.6	32.6	33.6	1.0
C	0.51	29	128	3.3	39.5	39.5	39.6	0.1
D	0.62	58	148	2.9	43.3	43.3	43.6	0.3
E	0.73	22	77	5.5	45.9	45.9	46.9	1.0
F	0.86	29	99	4.3	51.1	51.1	51.7	0.6
G	0.97	19	79	5.4	53.6	53.6	53.8	0.2
H	1.07	19	61	7.0	56.6	56.6	56.7	0.1
I	1.11	22	82	5.2	57.8	57.8	58.4	0.6
J	1.17	39	135	3.1	63.8	63.8	64.0	0.2
K	1.27	11	39	10.9	69.0	69.0	69.0	0.0
L	1.34	27	174	1.9	77.7	77.7	77.7	0.0
M	1.42	36	155	2.1	77.8	77.8	77.9	0.1
N	1.44	17	88	3.7	78.0	78.0	78.1	0.1
O	1.55	30	46	7.1	85.2	85.2	85.2	0.0
P	1.66	85	91	3.6	95.3	95.3	95.3	0.0
Q	1.74	24	6	7.1	103.2	103.2	103.6	0.4
R	1.77	19	77	4.2	110.7	110.7	110.9	0.2
S	1.80	13	65	5.0	113.2	113.2	113.8	0.6
T	1.83	39	201	1.6	113.5	113.5	114.5	1.0
U	1.89	11	30	10.8	117.6	117.6	117.9	0.3
V	1.94	64	51	6.4	124.4	124.4	124.4	0.0
W	1.97	12	32	10.1	127.0	127.0	127.2	0.2
X	2.03	16	74	4.4	134.6	134.6	134.8	0.2
Y	2.09	28	44	7.4	137.5	137.5	137.6	0.1
Z	2.14	18	40	8.2	142.9	142.9	142.9	0.0

[1] Miles above mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

TIBBETTS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Tibbetts Creek (Cont'd)								
AA	2.19	38	48	6.7	148.7	148.7	148.8	0.1
AB	2.23	31	39	8.4	157.0	157.0	157.0	0.0
AC	2.28	7	55	5.9	175.8	175.8	175.8	0.0
AD	2.29	22	111	2.9	176.2	176.2	176.4	0.2
AE	2.33	8	53	6.1	182.5	182.5	182.8	0.3
AF	2.34	24	61	5.4	182.5	182.5	183.1	0.6
AG	2.38	160	30	10.9	187.3	187.3	187.4	0.1

[1]Miles Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

TIBBETTS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Tolt River								
A[2]								
B	2,350	2,170	8,231	2.7	73.3[3]	70.7[5]	71.4[5]	0.7
C	2,880	1,500	6,797	3.2	76.6	76.6	76.7	0.1
D	3,235	1,300	6,219	3.5	77.0	77.0	77.7	0.7
E	3,740	1,200	5,424	4.1	78.1	78.1	79.0	0.9
F	4,345	1,300	3,833	5.7	81.2	81.2	81.9	0.7
G	4,775	778	3,376	6.5	84.1	84.1	85.1	1.0
H	5,390	570	2,697	8.2	88.9	88.9	89.9	1.0
I	5,835	492	4,137	5.3	93.4/93.4/92.4[4]	93.4[6]	93.6[6]	0.2
J	6,355	1,000	6,880	3.2	95.6/95.9/94.6[4]	95.4[6]	95.8[6]	0.4
K	7,030	642	3,226	6.8	97.8/98.1/98.0[4]	97.6[6]	98.0[6]	0.4
L	7,690	650	3,324	6.6	100.8/102.4/102.3[4]	100.7[6]	101.5[6]	0.8
M	8,300	810	3,099	7.1	104.2/105.0/104.6[4]	103.7[6]	104.6[6]	0.9
N	9,055	900	4,302	5.1	108.4/110.3/108.9[4]	107.9[6]	108.7[6]	0.8
O	9,735	856	4,365	5.0	111.7/112.8/112.5[4]	111.6[6]	112.4[6]	0.8
P	10,595	1,272	4,853	4.5	116.3/116.2/116.2[4]	116.3[6]	117.2[6]	0.9
Q	11,185	902	4,355	5.1	119.5	119.5	120.3	0.8
R	12,365	707	3,515	6.3	126.2	126.2	126.8	0.6
S	13,160	693	3,321	6.6	132.7	132.7	133.1	0.4
T	13,920	1,068	4,487	4.9	138.2	138.2	139.1	0.9
U	14,860	287	2,059	10.7	145.3	145.3	146.0	0.7
V	15,385	1,100	5,144	4.3	149.9	149.9	150.9	1.0
W	16,255	724	3,447	6.4	153.9	153.9	154.9	1.0
X	16,855	826	4,011	5.5	157.8	157.8	158.8	1.0
Y	17,625	855	5,149	4.3	161.6	161.6	161.7	0.1

[1] Feet above mouth
[2] Cross section located within Snoqualmie River Floodway
[3] Backwater from Snoqualmie River
[4] Landward of left levee/Riverward of levees/Landward of right levee
[5] Elevations calculated without consideration of backwater from Snoqualmie River
[6] Elevations computed without consideration of levees

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

TOLT RIVER

TABLE 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Tolt River (continued)								
Z	18,235	279	1,601	13.7	167.2	167.2	167.8	0.6
AA	19,045	1,102	5,668	3.9	174.2	174.2	175.2	1.0
AB	19,690	750	3,606	6.1	177.3	177.3	177.6	0.3
AC	20,340	632	3,508	6.3	180.8	180.8	181.7	0.9
AD	20,795	435	2,553	8.6	184.3	184.3	184.6	0.3
AE	21,555	352	2,628	8.4	189.6	189.6	190.1	0.5
AF	22,135	752	4,552	4.8	192.5	192.5	193.4	0.9
AG	22,935	805	3,276	6.7	196.5	196.5	197.3	0.8
AH	23,920	790	4,929	4.5	201.8	201.8	202.8	1.0
AI	24,280	436	2,806	7.8	203.3	203.3	204.2	0.9
AJ	24,730	434	2,984	7.4	206.5	206.5	207.4	0.9
AK	25,515	604	3,236	6.8	211.7	211.7	212.7	1.0
AL	26,265	380	2,722	8.1	217.7	217.7	217.7	0.0
AM	26,755	363	3,138	7.0	220.3	220.3	220.7	0.4
AN	27,255	334	2,245	9.8	223.2	223.2	223.4	0.2
AO	27,795	371	3,194	6.9	226.5	226.5	227.4	0.9
AP	28,610	374	2,647	8.3	230.2	230.2	231.2	1.0
AQ	29,355	379	2,434	9.0	234.9	234.9	235.8	0.9
AR	30,150	230	2,046	10.8	240.9	240.9	241.9	1.0
AS	30,900	190	1,747	12.6	248.1	248.1	248.8	0.7
AT	31,365	235	2,050	10.7	254.1	254.1	254.4	0.3
AU	31,770	377	3,878	5.7	258.8	258.8	259.7	0.9

[1] Feet above mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

FLOODWAY DATA

TOLT RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NGVD)		
UPPER NORTH OVERFLOW								
A	300	161	783	2.7	441.3	441.3	442.0	0.7
B	475	161	819	2.6	441.4	441.4	442.2	0.8
C	2,000	123	319	6.7	446.1	446.1	446.7	0.6
D	2,600	166	552	3.9	449.3	449.3	449.6	0.3
E	3,050	188	301	7.2	452.0	452.0	452.3	0.3
F	3,200	187	334	6.4	453.6	453.6	453.8	0.2
G	3,900	95	379	5.7	456.6	456.6	457.0	0.4

[1] Stream distance in feet above convergence with Upper South Overflow

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

UPPER NORTH OVERFLOW

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY FEET (NGVD)	WITH FLOODWAY FEET (NGVD)	INCREASE
UPPER SOUTH OVERFLOW								
A	2,200	111	398	10.8	436.8	436.8	437.0	0.2
B	2,900	175	1,025	4.2	441.3	441.3	442.0	0.7
C	3,900	84	327	6.6	445.0	445.0	445.2	0.2
D	4,700	127	611	3.5	450.7	450.7	451.2	0.5
E	5,650	203	379	5.7	452.7	452.7	453.0	0.3

[1] Stream distance in feet above confluence with South Fork Snoqualmie River

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

UPPER SOUTH OVERFLOW

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Walker Creek								
A	290	132	217	5.0	11.0	11.0	11.4	0.4
B	510	134	482	2.2	12.2	12.2	13.1	0.9
C	710	254	809	1.3	12.6	12.6	13.4	0.8
D	920	35	98	4.7	12.9	12.9	13.6	0.7
E	1,100	34	106	4.3	14.2	14.2	14.7	0.5
F	1,160	7	35	9.0	16.1	16.1	17.1	1.0
G	1,200	20	97	3.2	16.3	16.3	17.3	1.0
H	1,410	20	49	5.8	17.1	17.1	18.0	0.9
I	1,600	20	37	7.7	21.9	21.9	22.0	0.1
J	1,720	15	50	5.7	23.7	23.7	24.6	0.9

[1]Feet Above Mouth

[2]Because of Map Scale Limitations, All Floodway Widths Less Than 30 Feet Are Shown As 30 Feet

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

WALKER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
West Fork Issaquah Creek								
A	130	21	74	7.5	231.1	231.1	232.1	1.0
B	230	10	45	12.4	234.6	234.6	234.6	0.0
C	404	24	181	3.0	240.2	240.2	240.2	0.0
D	1,304	35	69	8.0	255.6	255.6	255.7	0.1
E	2,204	22	59	9.3	273.2	273.2	273.2	0.0
F	3,384	24	59	8.9	305.0	305.0	305.0	0.0
G	4,214	30	70	7.6	313.2	313.2	313.3	0.1
H	4,394	22	76	7.0	314.9	314.9	315.1	0.2
I	4,508	39	214	2.5	318.3	318.3	319.2	0.9
J	4,708	88	468	1.1	318.3	318.3	319.3	1.0
K	4,917	156	703	0.8	318.4	318.4	319.4	1.0
L	5,267	167	467	1.1	318.4	318.4	319.4	1.0
M	5,570	139	278	1.2	318.6	318.6	319.6	1.0
N	6,570	26	48	6.9	320.2	320.2	320.2	0.0
O	7,740	27	108	1.9	322.6	322.6	323.4	1.0
P	7,966	26	93	2.1	323.9	323.9	324.8	0.9
Q	8,346	26	104	1.9	324.6	324.6	325.2	0.6
R	8,774	28	115	1.7	325.0	325.0	325.7	0.7
S	9,324	64	165	1.2	325.1	325.1	325.9	0.8
T	9,796	176	422	0.5	325.1	325.1	326.1	1.0
U	10,521	119	139	1.4	325.1	325.1	326.1	1.0
V	10,806	136	541	0.4	325.1	325.1	326.1	1.0
W	11,456	62	204	1.0	325.1	325.1	326.1	1.0

[1]Feet Above Mouth

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

WEST FORK ISSAQUAH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
White River								
A - D[2]								
E	6.47	448	2,831	6.5	90.1	90.1	90.1	0.0
F	6.69	380	1,498	12.3	92.8	92.8	92.8	0.0
G	6.84	329	1,444	12.7	99.0	99.0	99.0	0.0
H	7.04	295	1,327	13.9	106.1	106.1	106.1	0.0
I	7.27	189	1,258	14.6	112.7	112.7	112.7	0.0
J	7.43	215	1,400	13.1	118.3	118.3	118.3	0.0
K	7.51	223	1,276	14.4	120.5	120.5	120.5	0.0
L	7.63	242	1,768	10.4	125.1	125.1	125.1	0.0
M	7.79	314	1,937	9.5	128.6	128.6	128.6	0.0
N	8.01	334	1,938	9.5	134.5	134.5	134.5	0.0
O	8.19	240	1,274	14.4	141.2	141.2	141.6	0.4
P	8.59	300	2,298	8.0	155.6	155.6	156.0	0.4

[1] Miles Above Mouth

[2] Floodway Not Applicable

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

WHITE RIVER

5.0 INSURANCE APPLICATION

For floodplain 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 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown are selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year 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 AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheetflow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where the average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown 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.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map 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 100-year floodplains that were studied by detailed methods, shows selected whole-foot based flood elevations or average depths. Insurance agents use the zones and base flood elevations 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 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current Flood Insurance Rate Map presents flooding information for the entire geographic area of King County. Previously, separate Flood Insurance Rate Maps were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in the Community Map History data (Table 5).

7.0 OTHER STUDIES

Due to its more detailed hydraulic analyses, this Flood Insurance Study supersedes all previous Flood Insurance Studies/Flood Insurance Rate Maps covering King County and the incorporated areas (References 1 to 18, 90, and 91). The City of Bothell and the Town of Milton have individual effective Flood Insurance Studies. (References 92 and 93, respectively).

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISION DATE(S)	FLOOD INSURANCE RATE MAP EFFECTIVE DATE	FLOOD INSURANCE RATE MAP REVISION DATE(S)
Algona, City of[1]	N/A	N/A	N/A	N/A
Auburn, City of	May 24, 1974	September 19,1975 February 18, 1977	June 1,1981	
Beaux Arts Village, Town of[1]	N/A	N/A	N/A	N/A
Bellevue, City of	August 2, 1974	August 13, 1976	December 1, 1976	February 23, 1982
Black Diamond, Town of	July 25, 1975	October 30, 1979	October 30, 1979	--
Bothell, City of	May 24, 1974	November 12, 1976	June 1, 1982	March 2, 1994
Burien, City of		--	--	--
Carnation, City of	May 31, 1974	March 5, 1976	March 4, 1980	--
Clyde Hill, Town of[1]	N/A	N/A	N/A	N/A
Des Moines, City of	June 28, 1974	January 2, 1976	May 15, 1980	November 15, 1985
Duvall, Town of	August 20, 1976	--	June 4, 1980	--
Enumclaw, City of	September 29, 1989	--	September 29, 1989	--
Hunts Point, Town of[1]	N/A	N/A	N/A	N/A
Issaquah, City of	February 8, 1974	February 25, 1977	May 1, 1980	--
Kent, City of	June 7, 1974	April 22, 1977	April 1, 1981	--
Kirkland, City of	June 28, 1974	September 12, 1975	June 15, 1981	--
Lake Forest Park, City of	June 28, 1974	February 27, 1976	February 15, 1980	
Medina, City of[1]	N/A	N/A	N/A	N/A
Mercer Island, City of[1]	N/A	N/A	N/A	N/A
Normandy Park, City of	June 28, 1974	October 31, 1975	November 2, 1977	August 5, 1980
North Bend, City of	May 17, 1974	May 7, 1976	August 1, 1984	--
Pacific, City of	June 28, 1974	December 26, 1975	December 2, 1980	--
Redmond, City of	March 22, 1974	July 9, 1976	February 1, 1979	January 19, 1982
Renton, City of	June 7, 1974	November 7, 1975	May 5, 1981	--
SeaTac, City of		--		--
Seattle, City of	November 22, 1974	July 19, 1977	July 19, 1977	--
Skykomish, Town of	February 14, 1975	--	July 2, 1981	--
Snoqualmie, City of	December 21, 1973	--	July 5, 1984	--
Tukwila, City of	May 24, 1974	September 13, 1977	August 3, 1981	--
Unincorporated Areas	January 17, 1975	--	September 29, 1978	--
Woodinville, City of		--		--
Yarrow Point, Town of[1]	N/A	N/A	N/A	N/A

[1]Non-floodprone community

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA, Mitigation Division, Federal Regional Center, 130 228th Street, SW, Bothell, Washington 98021-9796.

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10.0 REVISION DESCRIPTIONS

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Department of Land and Water Resources, 201 South Jackson Street, Suite 600, Seattle Washington 98104-3855.

10.1 First Revision

The purpose of this revision is to update the corporate limits of the City of Bothell and to add floodplain information for Miller Creek that affects the unincorporated areas of King County, Washington (Reference 94), and the incorporated Cities of Normandy Park (Reference 11) and SeaTac. Approximately 4.0 miles of Miller Creek were studied by detailed methods. The revised floodplain along North Creek shown within the City of Bothell is for information only. For flood insurance purposes, refer to the separately published Flood Insurance Rate Map.

The hydrologic and hydraulic analyses were performed by Northwest Hydraulic Consultants, Inc. (NHC), for FEMA under Contract No. EMW-90-C-3134. This work was completed in September 1991.

Various contacts for information were made by the study contractor in October, November, and December 1990. Coordination with the regional project office and county and city officials, as well as local residents, produced a variety of information pertaining to flood history, available community maps, and other hydrologic data.

Detailed methods were used to study 4.0 miles of the study reach extending from Puget Sound upstream to the proposed King County Lake Reba detention facility near State Route 518.

Approximate methods were used to study the 0.4-mile-long Tub Lake Tributary located just upstream of the proposed detention facility. This minor channel is dry except during flood events.

Miller Creek passes through several communities as it flows downstream to Puget Sound. The upper end of the study reach passes through the newly formed City of SeaTac. About mid-reach, the channel passes under Des Moines Way (near State Route 509) and enters unincorporated King County. Downstream of 1st Avenue South, near 6th Avenue SW, the channel enters the City of Normandy Park and remains within the city limits until it empties into Puget Sound. Land neighboring the stream channel is occupied by private residences and forest, farm, and pasture lands.

The average annual precipitation, as recorded at the nearby Seattle-Tacoma International Airport, is approximately 38 inches. The heaviest rainfall occurs during the months of November through January, with little rainfall during the summer months of July and August. The average annual temperature is 50°F, with average daily highs of 59°F and lows of 44°F. July and August are the warmest months, with average daily maximum temperatures of 75°F, while January is the coldest, with average daily minimum temperatures of 34°F.

Flood Problems and Flood Protection Measures

On January 8, 1990, a flood on the order of a 100-year event inundated farm lands, pasture lands, and residential yards neighboring the creek. Farm and pasture lands sustained no significant damage, but several homes did. A homeowner located at the northwest corner of South 160th and 9th Avenue South reported 4 feet of water in her basement. The yard of the home located on the southwest corner of this intersection was severely eroded by high-velocity water issuing from the culvert that conveys Miller Creek flow under 160th Avenue. Near 8th Avenue South, the stream jumped its west bank and damaged the contents of a garage/workshop. Several homes between 8th Avenue South and Des Moines Way were also flooded.

Downstream from 1st Avenue, the creek is confined to a deep ravine, which does not pose a threat to neighboring property. As it leaves the ravine, the creek flows along the west side of the Southwest Suburban Sewer District sewage treatment plant. During the January 1990 flood, the creek remained within its banks through this reach. Below the treatment plant, the stream profile begins to flatten and the floodplain widens. Two homes at the intersection of Miller Creek and SW 175th Place were flooded. Below SW 175th Place, the floodplain widens and has been preserved as a community park for residents of the City of Normandy Park. Much of it was also covered by water during the flood.

In October 1992, King County completed the construction of the Lake Reba Regional Stormwater Detention Pond, which will attenuate flood flows in Miller Creek. The facility is located at the site of Lake Reba, just south of State Route 518. The effect of this facility has been accounted for in the hydrologic and hydraulic analyses. There are no other major structural flood-protection measures planned for Miller Creek.

Hydrologic Analysis

Estimation of flood discharges along Miller Creek and its tributaries was based on a previous study performed by NHC in 1990 for the King County Division of Surface Water Management (Reference 95). In this study, the Environmental Protection Agency's Hydrologic Simulation Program - FORTRAN (HSPF) model (Reference 96), was used to describe the hydrology of the Miller

Creek basin. HSPF is a state-of-the-art hydrologic simulation model that is rapidly becoming the model of choice for simulating streamflow values by many government and private agencies. The model was used to compute time series of streamflows estimated from observed rainfall, evaporation, and soil-characteristic data. The model included the effect of the Lake Reba Regional Stormwater Detention Pond, which was constructed in 1992 near the headwater of Miller Creek.

The Miller Creek basin HSPF model was calibrated using 2 years of recorded streamflow data collected at a gage near the Southwest Suburban Sewer District treatment plant, recorded precipitation at the National Weather Service SeaTac weather station, and evaporation data from the Puyallup station. Calibration was performed for current basin land-use conditions.

To develop flood-frequency curves, the calibrated model was then used to simulate Miller Creek streamflows. A time series of streamflow values was created for the 29 years between October 1, 1961, and January 11, 1990, using historical SeaTac precipitation and Puyallup evaporation data. Log-Pearson III distributions were fit to the annual peaks from the simulation to determine the 10-, 50-, 100-, and 500-year flood discharges for Miller Creek. It should be noted that considerable extrapolation was required to determine the 100- and 500-year flow rates. The areas of Tub Lake Tributary make part of the total of 22 subbasins of the main stem of Miller Creek. Flood estimates for the Tub Lake Tributary were also computed using the HSPF model. Peak discharge-drainage area relationships for the stream studied by detailed methods are shown in Table 1, "Summary of Discharges."

Hydraulic Analyses

Analyses of the hydraulic characteristics of Miller Creek were carried out to provide estimates of flood elevations for the 10-, 50-, 100-, and 500-year events. Water-surface elevations were computed using the September 1990 release of the COE HEC-2 backwater computer program (Reference 97). Data required to develop the HEC-2 model include channel and floodplain geometry, roughness coefficients, and starting water-surface elevations. Cross-section data for the backwater analyses were obtained from field surveys performed between November 1990 and January 1991. A total of 32 sections were surveyed. All significant bridges, culverts, and weirs were surveyed to obtain elevation data and structural geometry. A total of six bridges, eight culverts, and 11 weirs were surveyed.

In the HEC-2 program, the special bridge routine was used for bridges with piers and for those where pressure flow occurred. The normal bridge routine was used for bridges without piers and for low-flow conditions where the water surface was below the low-chord elevation of the bridge. Local residents have built a number of small, wooden foot bridges across the creek. These were not included in the model.

Water-surface elevations at each culvert were also computed using the HEC-2 model, which incorporates the capability to simulate culvert hydraulics using Federal Highway Administration culvert procedures. For weir flow, water-surface elevations at each weir were computed using the HEC-2 model. The geometry of each weir was defined in the model, and water-surface elevations were computed using standard step-backwater analyses.

Channel roughness (Manning's "n") values used in hydraulic computations were determined using engineering judgment, reference to classical publications (References 98 and 99), and calibration to observed conditions. Flood profiles were matched with high-water marks and discharge data collected during January and February 1991 events. Selected channel "n" values range from 0.040 to 0.057, and overbank values range from 0.070 to 0.110.

The starting water-surface elevation was calculated using the slope-area method, based upon an assumed water-surface slope of 0.003.

Tub Lake Tributary flows from a depression area south of Beverly Park along Des Moines Way heading south. It then empties into the Lake Reba Detention Pond through a culvert underneath State Highway 518. Because this is a minor tributary to the mainstem of Miller Creek, approximate methods were used to assess the flood hydraulics. This tributary consists of approximately 1,300 feet of open channel and 250 feet of piped segments. From its confluence with Miller Creek, the tributary begins as an open channel. Approximately 900 feet upstream, a 200-foot long, 18-inch-diameter steel pipe carries flow under a little league baseball field. Upstream, 400 feet of open channel carry flow from a 240-inch-diameter corrugated metal pipe (CMP) culvert that conveys flow under South 144th Street. The Tub Lake marsh area begins north of South 144th Street. Both open channel reaches are represented in the HEC-2 model by a trapezoidal cross section that has a 4-foot depth, a 4-foot bottom width, and 2H:1V side slopes. Channel and floodplain geometry used in the model were estimated from available topographic mapping and data collected during a site reconnaissance.

Channel roughness coefficients were assumed to be 0.065 for open channel, 0.070 for overbanks, 0.015 for the steel culvert, and 0.024 for the CMP culvert.

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

All elevations are referenced to the NGVD. Elevation reference marks (ERMs) and the descriptions of those marks used in this restudy are shown on the maps. The remaining descriptions are presented in Elevation Reference Marks (Exhibit 3).

ERMs were established at eight sites along the stream. Floodplain boundaries were delineated in the detailed study reach of Miller Creek and its tributary using topographic maps at a scale of 1:2,400, with 5-foot contour intervals, provided by the King County Department of Public Works and the City of Seattle Engineering Department.

The floodways developed in this study were computed with the HEC-2 model, generally with the assumption of equal-conveyance reduction from each side of the floodplain. Floodway widths were computed at each cross section. Between sections, the floodway boundaries were interpolated. The results of the floodway study are tabulated for each cross section in Table 4, "Floodway Data." No floodway was computed for the Tub Lake Tributary.

The information for this restudy of Miller Creek supersedes the data presented in the previous Flood Insurance Study for King County, dated September 29, 1989 (Reference 94). The discharges used in this study of Miller Creek were revised to account for the effects of urbanization and operations of the newly constructed Lake Reba Detention Pond. This restudy was completed in September 1991.

10.2 Second Revision

This study was revised on May 16, 1995, to incorporate the results of an analysis of existing hydraulic studies that was performed for the Snoqualmie River in the vicinity of the City of Snoqualmie. The analysis was performed by NHC, the study contractor, for FEMA under Contract No. EMW-90-L-3134, as part of its Limited Map Maintenance Program.

NHC compared the two hydraulic studies performed by Hosey & Associates for Puget Power and measured high-water marks with the profiles published by FEMA for the Snoqualmie River in the vicinity of the City of Snoqualmie. The most recent of these two studies incorporated updated topographic information and was calibrated using information from recent storms. When the profiles produced by these studies matched FEMA's profile, it was determined that a restudy of the area was not warranted at that time. However, upon comparison between the base (100-year) flood elevation (BFE) placements shown on Flood Insurance Rate Map Panels 53033C0737 E, 53033C0739 E, 53033C0741 E, and 53033C0743 E and those shown on the published profile, it was determined that the BFE placements shown on the above-mentioned Flood Insurance Rate Maps were incorrect. Therefore, the BFE placements shown on the above-mentioned Flood Insurance Rate Map panels were revised along the Snoqualmie River from approximately 1,530 feet upstream of State Highway 202 to its confluence with the South Fork Snoqualmie River to match those shown on the published profiles for that reach.

In addition to the above revision, the mapping for King County has been prepared using digital data. Previously published Flood Insurance Rate Map data produced manually have been converted to vector digital data by a digitizing process. These vector data were fit to raster digital images of the USGS quadrangle maps of the county area to provide horizontal positioning.

Road, highway names, and centerline data have been obtained from an enhanced TIGER (Topologically Integrated Geographic Encoding and Referencing) File, obtained through the King County Computer and Communications Services Division. For county areas outside of the City of Seattle, the centerlines were modified to the positional accuracy of the USGS quadrangle maps, and the roads, highways, and street names, if needed, were taken from the Flood Insurance Rate Map panels, where appropriate. The adjusted centerline data were then computer plotted with the digitized floodplain data to produce the countywide Flood Insurance Rate Map panels.

The ERM descriptions are now included on the individual Flood Insurance Rate Map panels. This information has been removed from the text. Also, several additional incorporated areas have been identified in this update. They are the Cities of Algona, Burien, Bothell, Federal Way, Hunts Point, Medina, Mercer Island, Woodinville, and Yarrow Point and the Towns of Clyde Hill and Beaux Arts Village.

The LOMR issued on December 18, 1990, for the City of North Bend, to show the effects of more detailed hydrologic/hydraulic information along the Snoqualmie River was included in this update. As a result of more detailed hydrologic/hydraulic information, the floodway was revised along the Snoqualmie River throughout the corporate limits of the City of North Bend.

The LOMR issued on May 13, 1992, for the unincorporated areas of King County, to show the effects of more detailed topographic information adjacent to the Sammamish River, was included in this update. As a result of the more detailed topographic information, the 100-year floodplain boundary was revised to exclude the K & S Business Park from the 100-year floodplain.

The LOMRs issued on April 28, 1994, for the City of Redmond and the unincorporated areas of King County, to show the effects of more detailed hydrologic/hydraulic information along Bear Creek, were included in this update. As a result of the more detailed hydrologic/hydraulic information, the Flood Insurance Rate Map was revised to modify elevations, floodplain and floodway boundary delineations, and zone designations along Bear Creek from its confluence with the Sammamish River to State Highway 202 (Redmond Way). In addition, a Flood Profile Panel was included for the Bear Creek Overflow Channel.

10.3 Third Revision

This study was revised on May 20, 1996, to incorporate the results of detailed hydrologic and hydraulic analyses of the Raging River affecting King County, Washington. The revised analyses for the reach of the Raging River from its confluence with the Snoqualmie River to approximately 0.6 mile upstream of Interstate Highway 90 (I-90) (downstream reach) were performed by Harper Righellis, Inc., Portland, Oregon, for the King County Surface Water Management Division. The revised analyses for the reach from approximately 0.6 mile upstream of I-90 to approximately 0.3 mile upstream of the second Upper Preston Road bridge (upstream reach) were performed by FEMA. This work was completed in March 1995.

The initial CCO meeting was held on October 27, 1993, and was attended by representatives of FEMA, King County, the consultant, and the community.

Prior to this revision, the reach of the Raging River from its confluence with the Snoqualmie River to I-90 had not been studied in detail and appeared as an approximate Zone A on the maps. The reach from I-90 to approximately 0.3 mile upstream of the second Upper Preston Road bridge was studied by detailed methods prior to this revision and appeared as Zone AE on the maps. The information for this restudy supersedes the data presented for the Raging River for both the upstream and downstream reaches.

The discharge values for the downstream reach were developed using a statistical analysis of the stream-gage data at USGS Gage No. 12145500 along the Raging River. The period of record from 1945 to 1992, plus an historic event in 1932, was used in the analysis. The discharge values from this revised hydrologic analysis are significantly higher than the discharge values from the Summary of Discharges Table in the previous Flood Insurance Study for King County, Washington and Incorporated Areas, dated September 29, 1989 (Reference 94), which were used in the detailed study performed by CH2M HILL, Inc., for the reach upstream of I-90. Therefore, FEMA revised the discharge values for the upstream reach using drainage area-discharge relationships established in the detailed hydrologic analysis for the downstream reach.

The hydraulic analysis for the revised study of the downstream reach was performed using the COE HEC-2 backwater computer program (Reference 97). Data for the cross sections, including overbank areas, were taken from field surveys performed in April 1993. A total of 52 sections were surveyed, including seven bridges. There are additional bridges along the Raging River that were not modeled because they do not affect the water-surface elevations of the river.

Channel and overbank roughness coefficients (Manning's "n") used in the computer program for the downstream reach were estimated from experience and field observations. Values range from 0.035 to 0.055 in the channel and from 0.050 to 0.090 in the overbank areas.

The starting water-surface elevation was obtained by the slope-area method based on an estimated slope of the energy-grade line.

Downstream of 328th Way to the confluence with the Snoqualmie River, the Raging River is confined between levees. However, these levees do not meet FEMA freeboard requirements. Therefore, the water-surface profiles for the area affected by the levees were computed as follows:

1. For the area between the levees, the profiles were determined considering that both levees would remain in plaçe.

2. For the right overbank (looking downstream), the profiles and floodplain boundary were determined without considering the effects of the right levee.

3. For the left overbank, the profiles and floodplain boundary were determined without considering the effects of the left levee.

For the upstream reach, the revised discharge values were used to complete a revised hydraulic analysis using HEC-2 and the cross-section information and Manning's "n" values from the previous Flood Insurance Study. The water-surface elevations increased by a maximum of 4.7 feet approximately 0.6 mile upstream of I-90 and the floodplain width increased by a maximum of 120 feet approximately 1.3 miles upstream of I-90.

The 100- and 500-year floodplain boundaries for both the upstream and downstream reaches were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Reference 100) for the downstream reach. The topographic work maps (Reference 65) from the previous Flood Insurance Study were used to delineate the floodplain boundaries between cross sections for the upstream reach. In cases where the lines are collinear, only the 100-year flood boundary has been shown.

The floodway determined for the Raging River was computed based on equal conveyance reduction from each side of the floodplain, and in the floodplain area downstream of 328th Way, the floodway was determined without consideration of the levees. Floodway widths were computed at each cross section. Between sections, the floodway boundaries were interpolated. In cases where the floodway line is collinear with the 100-year floodplain line, only the floodway line has been shown.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1).

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

All elevations are referenced to the NGVD. ERMs used in this study are shown on the maps.

Table 1, "Summary of Discharges," Table 3, "Manning's "n" Values," Table 4, "Floodway Data," and the Flood Profiles were revised to reflect the results of the study.

10.4 Fourth Revision

This study was revised on March 30, 1998, to incorporate the results of detailed hydrologic and hydraulic analyses of North Fork Issaquah Creek in the City of Issaquah, Bear and Evans Creeks in the City of Redmond, South Fork Skykomish River in the Town of Skykomish and the unincorporated areas of King County, and the Middle and North Fork Snoqualmie Rivers in the unincorporated areas of King County. This study also incorporates the results of an approximate analysis of Tate Creek in the unincorporated areas of King County.

The hydrologic and hydraulic analyses for North Fork Issaquah Creek were prepared by NHC, for FEMA, under Contract No. EMW-93-C-4152. This work was completed in September 1995.

The initial coordination meeting was held on October 20, 1994, and was attended by FEMA and NHC representatives.

Various agencies contacted for information include: the City of Issaquah and King County Public Works Departments; the Washington State Department of Transportation (WSDOT); and the COE, Seattle District. Local residents and engineers for private developers provided information pertaining to flood history and recent and proposed basin development.

North Fork Issaquah Creek is locally known as Jordan Creek. The study reach extends approximately 1.2 miles, beginning at the confluence with Issaquah Creek and ending at 230th Avenue SE. The study reach of North Fork Issaquah Creek is primarily located in the unincorporated areas of King County, but includes a very short segment that passes through the City of Issaquah at the I-90 interchange. North Fork Issaquah Creek originates in King County just northeast of the City of Issaquah and flows in a mostly southwesterly direction to the main stem of Issaquah Creek. The contributing basin area is approximately 4.5 square miles, ranging in elevation from approximately 60 feet near the mouth to a maximum elevation of approximately 1,200 feet.

Much of the upper basin was forested as of 1989. Since then, the major "Klahanie" urban development has largely been completed and covers most of the northern side of the upper basin. A second major urban development, "Grand Ridge," is presently in the planning stages and will cover most of the southern side of the upper basin.

Information on the frequency and extent of past flooding along North Fork Issaquah Creek is very limited, and no information is available for most of the study reach. Areas where past flooding has occurred were identified through interviews with local residents during field surveys made by NHC in October and November 1994, and during a 2-year flood event in February 1995.

At Issaquah Creek near the mouth, a 56.6-square-mile basin area, major floods with nearly identical peak flows, 3,100 and 3,200 cfs, respectively, were recorded on November 24, 1986, and January 9, 1990. These floods each had a return period of approximately 30 years. Major floods are believed to also have occurred on North Fork Issaquah Creek on the same dates. Coincident flooding is confirmed by a King County stream gage on the North Fork Issaquah Creek channel to have occurred on January 9, 1990; that gage had not yet been installed at the time of the 1986 flood.

No information on past flooding was available for the 0.7-mile reach between the 60th Street SE bridge and the I-90 interchange. Flooding of the area immediately upstream of the I-90 interchange occurred on several occasions after construction of this interchange in approximately 1968.

Additional information on past high-water levels is available from a stream gage operated by the King County Division of Surface Water Management (KCSWM) at the 66th Street SE bridge crossing of North Fork Issaquah Creek. The maximum water elevation recorded during the January 9, 1990, flood was 72.8 feet, which is approximately 0.6 foot below the low cord of the bridge. There are no existing flood-protection measures along North Fork Issaquah Creek.

Flows estimated using the HSPF flow are based on a model that was calibrated to streamflow data collected on North Fork Issaquah Creek for the years 1988 through 1990, based on the forested land-use conditions that existed. Peak flows from the calibrated HSPF model are substantially lower than other estimates primarily because the basin contains proportionally more highly permeable outwash soils than other gaged basins in the region.

Revisions to the King County HSPF model were made as part of the restudy to reflect major residential developments that have been constructed since 1989 and others that were in the planning stage as of 1995. The Klahanie and Grand Ridge developments will cover essentially all of the upper basin area. Both of these developments are located primarily within the North Fork Issaquah Creek basin, but extend across basin boundaries into other basins as well.

The Klahanie project is an 856-acre development located in the upper North Fork basin north of the Issaquah Fall City Road and covering approximately 25 percent of the North Fork basin (Reference 101). Construction for this development began in 1987 and was nearly complete as of 1995. Stormwater peak flows are controlled through a series of detention ponds including a major facility developed by construction of a control structure at the outlet of Yellow Lake within the development area. The stormwater facilities for the Klahanie development, and the Yellow Lake outlet control in particular, were designed so that peak flows leaving the site would not be increased as a result of the development.

The Grand Ridge project is a proposed 2,200-acre development located in the upper North Fork basin south of the Issaquah Fall City Road and which will cover approximately 50 percent of the North Fork basin. Environmental Impact Statement hearings for this project were in progress during 1995. Discussions with the project's engineers revealed that stormwater control is planned to be provided entirely through infiltration systems, which will preclude peak flows from developed areas being released directly to the stream system. With infiltration systems, the Grand Ridge development is not expected to cause any significant increase in peak flows in the North Fork basin.

While updating the HSPF model, it was discovered that the major stormwater detention control facility at Yellow Lake had been constructed in 1987 in advance of most other Klahanie development activity, but had not been included in the original HSPF model. Calibration of the original model had been attained to some extent by adjusting the model's pervious surface runoff parameters to reflect the flow attenuation effects actually caused by the outlet controls at Yellow Lake (Reference 102).

Because of the changing land use, neither the original calibrated HSPF model nor the revised model with 1989 land use are directly suitable for estimating flood discharges for 1995 conditions. The original flood frequency curve for the calibration period is artificially suppressed because of the timing of the HSPF calibration in relation to phasing of the Klahanie development: the Yellow Lake stormwater facility had been constructed, but the development to be serviced by that facility had not. The flood frequency curve from the revised model with 1989 land use underestimates the calibration-period flows by about 25 percent.

For purposes of the restudy, it is assumed that flows from the "HSPF Model Revised, 1995 Land Use" underestimate actual flows by 25 percent. The 25-percent value is based on the peak-flow reduction that resulted when the original calibrated model based on the 1989 land use was revised to include the Yellow Lake outlet control. For the restudy, a 100-year discharge of 315 cfs was used near the mouth of North Fork Issaquah Creek.

Flood discharges in the lower portion of the restudy reach are supplemented by floodwater originating from the main stem Issaquah Creek. Main stem Issaquah Creek channel overtopping between the I-90 crossing and the confluence with the North Fork channel is shown by high-water-mark information to have occurred during the November 1986 flood, and probably also the January 1990 flood, which had a nearly identical main-channel discharge (Reference 103). These floods each have a return interval of approximately 30 years. Water that overtops the right bank of the main stem Issaquah Creek channel downstream of the I-90 crossing will flow toward the North Fork channel.

Updated estimates of Issaquah Creek 100-year elevations affecting the North Fork channel have been reported by the City of Issaquah in 1992, based on a HEC-2 model that was calibrated to high-water marks for the January 1990 flood (Reference 103).

Estimates of Issaquah Creek overbank flow entering the North Fork channel were made by assuming weir flow in two segments that correspond to relatively low sections along the channel banks. The first (upstream) section was represented as a 500-foot-long weir located between Cross Sections C and D. The second (downstream) section was represented as a 200-foot-long weir between Cross Sections B and C. Average depths of flow over these sections under 100-year flood conditions were estimated to be 0.5 and 0.3, respectively. Depths of flow for 50- and 500-year events were estimated to be approximately 0.2 foot lower and 0.5 foot higher, respectively, than the 100-year flow depths. A broad-crested weir coefficient of 2.5 was assumed for computing overbank flow. Approximately 440 cfs additional flow enters North Fork Issaquah Creek from Issaquah Creek between Cross Sections C snd D, and approximately 80 cfs enters between Cross Sections B and C. The floodway analyses considered only the basin flows and did not include additional flows due to overtopping.

A detailed backwater model was created for the entire study reach using the February 1991 release of HEC-2 (Reference 104). An existing HEC-2 model of the lower portion of the study reach was obtained from King County and modified for purposes of the restudy.

The physical geometry of the North Fork Issaquah Creek channel was represented by 11 cross sections surveyed in 1989 and 1994. Channel cross sections were surveyed in April and May 1989 by David Evans and Associates (DEA) for King County at six locations from the mouth to just upstream of SE 64th Place. An additional five channel cross sections were surveyed in October and November 1994 by NHC to define the upstream portion of the study reach.

Floodplain geometry was estimated from 2-foot contour mapping obtained from the City of Issaquah Department of Public Works in digital and hard-copy format. The contour mapping was prepared by David C. Smith and Associates of Portland, Oregon, based on photography dated April 11, 1989.

Eight bridges, one rectangular weir, and a complex multiple-culvert crossing at the I-90 interchange are represented in the North Fork Issaquah Creek HEC-2 model. The data to define these structures were obtained from DEA surveys made for the lower portion of the study reach in 1989, from NHC field surveys made for the upper portion of the study reach in 1994, and from construction drawings for the I-90 interchange obtained from the WSDOT.

A small footbridge located approximately 20 feet upstream of the rectangular weir in the upstream portion of the study reach was not represented in the model. The footbridge spans the full channel without any fill or encroachments, and appeared unlikely to survive a major flood.

Approximate methods were used to assess the complex culvert crossing at the I-90 interchange. The existing crossing consists of an original dual-culvert system that was augmented by a large bypass culvert after the original system failed to perform satisfactorily.

The original I-90 crossing design was constructed in 1968/1969. It is a complex design with three sections of dual 42-inch- and 54-inch-diameter culverts at different invert elevations and slopes, alternating with two open-water sections in the areas enclosed by on and off ramps between I-90 and East Lake Sammamish Parkway. In each of the dual-culvert segments, one of the two culverts is constructed with zero slope. Sediment obstruction of the upstream (3.5-foot-diameter) zero-slope culvert is believed to have been a major cause of upstream flooding following completion of the original crossing design. The I-90 crossing design was substantially modified in 1973, with the addition of a single 260-foot-long, 66-inch-diameter bypass culvert beneath East Lake Sammamish Parkway.

The complex crossing at the I-90 interchange is represented in the HEC-2 model by an equivalent culvert that was determined using the WSDOT's HY-8 culvert program. In determining an equivalent culvert, it was assumed that the zero-slope culvert from the original design is completely ineffective due to sediment obstruction, consistent with verbal reports that such blockage has occurred during past flood events. All remaining culverts were assumed to be in good hydraulic condition and free of blockages.

Individual rating curves based on a constant (approximately 100-year) tailwater level of 66.5 feet were determined for the two active flow paths, and manually summed to derive a composite rating curve. An equivalent culvert was then determined by trial and error so that the equivalent rating curve matches the composite rating curve at the 100-year discharge.

The equivalent culvert used in the HEC-2 model is a single 6.3-foot-diameter culvert that is 250 feet long and follows the alignment and slope of the bypass culvert under East Lake Sammamish Parkway.

Channel roughness values (Manning's "n") in the HEC-2 model were determined by calibration to observed water levels and by reference to USGS Water Supply Papers 1849 and 2339, which discuss roughness characteristics of natural channels and floodplains (References 105 and 106).

Manning's "n" values ranged from 0.03 to 0.12 for channel sections and from 0.06 to 0.20 for overbank areas. The highest channel roughness values correspond to reaches of the channel having well-established trees and other vegetation within the sections coded in the HEC-2 model as being the main channel section. The values presented in the model are reasonable in relation to values presented by the USGS (1978 and 1989) (Reference 106).

Inundated areas that do not convey flow were assigned "n" values of 0.99 or higher. High "n" values were defined during the hydraulic analysis of the 100-year flood condition and were used to balance the horizontal distribution of main-channel and overbank flows, with consideration of contraction and expansion of flow upstream and downstream of bridge crossings.

Starting water-surface elevations for the analysis assume coincident peak water levels in the main stem Issaquah Creek channel. Coincident peaks were assumed because 100-year flood conditions in the lower reach of North Fork Issaquah Creek will be dominated by flows that originate from the main stem channel.

There are floodplain boundary discontinuities between the North Fork Issaquah Creek and main stem channels in the vicinity of Cross Section D. Issaquah Creek floodplain boundaries through this reach were last studied in 1977. Most of the Zone X areas between the North Fork Issaquah Creek and main stem channels are subject to inundation during a 100-year flood on Issaquah Creek.

The normal depth of flow was used to determine the starting water-surface elevation for the floodway analysis.

The flood risk in the upper study reach from SE 66th Street to the downstream crossing at the I-90 interchange is highly dependent on culvert maintenance at the I-90 interchange and on channel aggradation upstream from the rectangular weir located in this reach. At the I-90 interchange, it was assumed for the restudy that the zero-slope culvert of the original design is fully obstructed, but that the second (sloping) culvert from the original design plus the bypass culvert are both maintained to be in good hydraulic condition. It was further assumed that the channel from the SE 66th Street bridge to the rectangular weir is not prone to aggradation, which would cause a significant reduction of the channel capacity.

The floodway boundaries developed in the restudy were computed with the HEC-2 model based on the North Fork basin 100-year discharge of 315 cfs, which excludes any additional flow originating from the main stem Issaquah Creek. The starting water level for the encroachment analyses was set at 1 foot above the normal depth of flow for the 100-year discharge of 315 cfs.

The stream has a small active channel, typically approximately 10 feet wide and 3 feet deep, which is contained within a larger main channel that is typically approximately 35 to 50 feet wide and 8 feet deep. Top-of-bank stations in the HEC-2 model are coded to reflect the smaller active channel in order to recognize substantial variations in roughness across the larger main channel. However, top-of-bank stations corresponding to the larger main channel are more appropriate in the context of determining minimum floodway widths.

The floodway width and other floodway data that correspond to encroachment limits set at the top of the main channel banks were incorporated in Table 4, "Floodway Data."

The profile for North Fork Issaquah Creek was revised as a result of the restudy.

The hydrologic and hydraulic analyses for the restudy along Bear and Evans Creeks were prepared by NHC, for FEMA, under Contract No. EMW-93-C-4152. This work was completed in September 1995. The initial coordination meeting was held on October 20, 1994, and was attended by representatives of FEMA and NHC.

Various agencies contacted for information included: the WSDOT; City of Redmond Public Works Department; KCSWM; King County Engineering Department; and the COE, Seattle District. The following engineering consultants, who performed previous hydraulic analyses of Bear Creek, were also contacted for information: CH2M Hill; Montgomery Water Group, Inc.; Alpha Engineering Group, Inc.; Land Tech; and Robert Parrott. In addition, local residents and business owners provided helpful information pertaining to previous flooding and development history along Bear Creek.

The restudy covers riverine flooding on approximately 4.6 miles of Bear Creek, a tributary to the Sammamish River. The restudy reach extends from approximately 5,000 feet upstream of the mouth at the Sammamish River, at State Route 202, to approximately 250 feet upstream of the confluence of Bear and Cottage Lake Creeks at Avondale Road NE.

The restudy included detailed and approximate hydraulic analyses to estimate floodplain and floodway boundaries along the entire study reach. Detailed methods were used to determine the floodway boundaries and estimate the majority of the floodplain along Bear Creek. Approximate methods were used to determine depths of flow and inundation limits in the overbank area associated with a flow split downstream of NE 95th Street near the Friendly Village mobile-home park. At the upstream end of the study reach, the detailed hydraulic analyses were extended approximately 420 feet upstream of Avondale Road NE to tie into the previous study (Reference 94). A detailed hydraulic analysis was made of the lower 0.74 mile of Evans Creek to tie into the previous study for that creek (Reference 94). Approximate methods were used to determine flow depths and inundation limits on the right overbank of Evans Creek. Flow reaches this overbank area via two locations where flow splits from the main channel at high flow.

The hydraulic analyses performed for the restudy only extended up Cottage Lake Creek approximately 150 feet to include the entire width of the floodplain shared jointly by the two creeks. No further analysis or floodplain mapping was performed for Cottage Lake Creek.

Most of the Bear Creek study reach lies along Avondale Road NE, which is the extension of State Route 520. Avondale Road NE runs primarily north-south and crosses Bear Creek at three locations approximately at River Miles 1.4, 5.4, and 5.7 (Reference 107). The most upstream Avondale Road NE crossing is the upstream limit of the restudy. Bear Creek originates in an extensive network of wetlands near Paradise and Echo Lakes in southern Snohomish County, and flows primarily southward for approximately 14 miles to its confluence with the Sammamish River (Reference 105). The contributing drainage area is approximately 51 square miles at its mouth.

The lower portion of the restudy reach flows through a flat floodplain that ranges in width from approximately 250 feet wide downstream of Union Hill Road to nearly 1,800 feet wide downstream of the confluence of Bear and Evans Creeks. Most of the lower portion of the floodplain is bounded by road or business park fills including those of State Routes 202 and 520, Union Hill Road, Avondale Road Extension, Avondale Road NE, Bear Creek Business Park (Harvard College), and Redmond Village. Beginning approximately one-half mile upstream of the confluence with Evans Creek, the Bear Creek floodplain is generally narrower, ranging between 200 and 350 feet wide, bordered by gentle, rolling hills.

Some flow may overtop sections of Union Hill Road upstream of Avondale Road NE. Although the area near Union Hill Road is presently developed, these flows were assumed to be relatively minor.

Discharges from the previous study dated September 1989 were used directly at three locations in the HEC-2 model: at the downstream end of the study reach on Bear Creek, near the mouth of Evans Creek, and at the upstream end of the study reach above the confluence with Cottage Lake Creek. Discharges at other points in the study reach were recomputed after review of the previous model indicated discharges at intermediate points were not consistent or reasonable.

Because discharges for intermediate points along the main stem of Bear Creek appeared unreasonable in the previous study, new discharges were computed based on a combination of the peak flows at the mouth of Bear Creek and the distribution of flows across the study reach computed by Entranco Engineers, Inc., in the 1993 HSPF hydrologic analysis (Reference 108). To determine the flow at any point along Bear Creek, the appropriate recurrence interval flow at the downstream end of the study reach, from the previous study, was multiplied by the ratio of discharges at the two locations from the Entranco analysis. Discharges along Bear and Evans Creeks were incorporated in Table 1, "Summary of Discharges."

The KCSWM developed detailed backwater models of Bear, Evans, and Cottage Lake Creeks for the 1990 Bear Creek Basin Plan using the COE HEC-2 model (Reference 104).

The HEC-2 model was modified as follows:

- More detailed cross-section data from a recent LOMR issued April 28, 1994, on lower Bear Creek were substituted for the King County data for the reach between State Route 202 and Union Hill Road (Reference 109).

- The representation of the Union Hill Road bridge was updated to reflect the construction of a new bridge in 1994.

- The KCSWM HEC-2 model was augmented with additional detailed cross-section data from a 1986 hydraulic investigation for the reach between Union Hill Road and the Redmond Animal Clinic (Reference 110).

- Encroachment cards in the KCSWM HEC-2 model, used to limit effective flow areas at bridges, were replaced with NH cards to facilitate floodway analyses. The locations of the fully expanded flow sections were also adjusted consistent with recommendations in the HEC-2 User's Manual.

- The model configuration at several bridges was updated to more accurately simulate roadway overtopping and corresponding hydraulic losses.

- Split-flow analyses were included to represent areas in the Bear and Evans Creeks models where significant flow exits the main channel and flows in a hydraulically separate flow path before returning to the main channel downstream.

- The Bear Creek model was updated to reflect recent bridge replacements on Avondale Road NE at the two most upstream crossings, approximately at River Miles 5.4 and 5.7. Updated bridge geometry was based on NHC field surveys performed in August 1995.

- The model was calibrated to high-water marks from the January 18, 1986, and January 10, 1990, flood events. Calibration led to modifications in Manning's "n" roughness values and the addition of several intermediate cross sections.

The physical geometry of the Bear Creek channel was represented by 74 surveyed cross sections. These cross sections were developed primarily by the KCSWM based on field surveys by DEA in 1987. Surveyed cross sections were extended by the KCSWM using the 1987 aerial topographic mapping prepared by David Smith and Associates. Some cross sections were further extended by NHC to encompass the entire Bear Creek floodplain. Intermediate cross sections were added at several locations to improve the model's stability and accuracy or as necessary for computation of bridge expansion and contraction losses. These were developed by interpolating the channel portion of adjacent cross sections and extending the overbanks based on the topographic base map.

Simulated water-surface elevations, field reconnaissance, and anecdotal reports from residents indicate that during severe floods, flow breaks out of the main Bear Creek channel downstream of NE 95th Street and passes to the east of the Friendly Village mobile-home park. This split flow travels overland in a southerly direction, joins floodwater from Evans Creek, and returns to the Bear Creek system near the confluence of these creeks. The split flow was modeled in the HEC-2 model using the weir split-flow option. The split flow returns to Bear Creek via the Evans Creek overbank so the modeled Evans Creek discharges were modified to reflect this additional flow.

Because the Bear Creek split flow affects water-surface elevations in Evans Creek, and the two creeks jointly share an extensive floodplain at their confluence, the restudy included detailed hydraulic modeling of Evans Creek from its mouth at Bear Creek upstream to River Mile 0.74.

For the portion of Evans Creek investigated in the restudy, 12 cross sections were used to define the channel and floodplain geometry. These include one at the confluence with Bear Creek, one just upstream of the confluence with Bear Creek where the floodplain is shared jointly by the two creeks, and one further upstream where the Evans Creek floodplain conveys part of the flow from the flow split in Bear Creek. Beginning approximately at River Mile 0.3, Evans Creek is characterized by a well-defined channel with a relatively steep left bank rising well above flood stages to a developed area. The right channel bank also rises steeply to residential areas above the floodplain with the exception of two locations, one downstream of River Mile 0.50 and a second approximately at River Mile 0.60. Cross sections upstream of River Mile 0.3 were extracted from the King County HEC-2 model of Evans Creek. Cross sections downstream of River Mile 0.3 were developed by NHC from the available topographic and survey data.

Initial HEC-2 model results indicated that during significant floods, water-surface elevations in Evans Creek would rise such that flow would split overbank at the two low points in the right channel banks and pass to the north of the developed areas on the right bank. Therefore, the HEC-2 formulation was modified to reflect a split-flow analysis with flow splits occurring in these locations and returning to Evans Creek further downstream.

Nineteen bridges are represented in the Bear Creek HEC-2 model. The bridge shown on the base map downstream of NE 116th Street has been removed since the aerial photogrammetry was performed and, therefore, was not coded in the HEC-2 model. Bridges were coded as special bridges in HEC-2 if there was likely to be significant pressure flow at the bridge in the 100-year event or if the special bridge method provided more reasonable results for bridge hydraulic losses. Otherwise, bridges were coded as normal bridges.

Two bridges were coded in the Evans Creek HEC-2 model using the normal bridge method because simulated water-surface elevations would not cause pressure or weir flow during the 100-year event.

The representations of these bridges from the KCSWM HEC-2 model were not modified.

Roughness values (Manning's "n") used in the HEC-2 model were determined by calibrating the Bear Creek model to the January 18, 1986, and January 10, 1990, flood events. High-water data for these events were obtained from various sources, including a report by CH2M Hill for the City of Redmond (Reference 111); a hydraulic analysis by CH2M Hill for the WSDOT (Reference 112); and photographs by the City of Redmond, the owners of Friendly Village, and the owners of the Redmond Animal Clinic. Anecdotal reports of flooding were also provided by the owner of the farm near the confluence of Bear and Evans Creeks and the owners of property near the NE 106th and NE 116th Street crossings. These events are the most significant floods recorded in recent history and provide useful data for calibration of roughness coefficients both in the channel and on the overbank floodplain. Most of the calibration data are for the reach of Bear Creek downstream of NE 95th Street. For other reaches of the creek for which little or no calibration data were available, roughness coefficients were estimated using engineering judgment and reference to classical publications (References 113 and 114). Manning's "n" values range from 0.045 to 0.075 for the main channel and from 0.050 to 0.200 for the overbank and floodplain.

Starting water-surface elevations at the downstream end of the Bear Creek restudy reach were extracted from the most recent approved LOMR for lower Bear Creek by the Montgomery Water Group, Inc., (References 115-117).

Starting water-surface elevations for the Evans Creek HEC-2 model were extracted from the results of the Bear Creek model runs at the confluence of the two creeks.

The 1987 aerial photogrammetry and base maps show that the restudy reach of Bear Creek (between State Route 202 and the uppermost Avondale Road crossing) is approximately 0.4 mile longer than that shown in the previous study profiles. This could be the result of changes in the stream channel but is most likely a result of improved photogrammetric techniques. The revised profile panels are measured in feet above State Route 202 along the restudied portion of Bear Creek.

The floodplain boundaries for the 100- and 500-year events were taken from a topographic work map at a scale of 1:2,400. The base map was obtained from the KCSWM and was prepared by David Smith and Associates from aerial photographs taken in March 1987.

The floodway boundaries developed in the restudy were computed with the HEC-2 model, generally with the assumption of equal-conveyance reduction from each side of the floodplain (HEC-2 encroachment method 4). The floodway model run was complicated by several factors. First, subsequent to the preparation of the previous study, several large fills were placed in the floodway fringe, thus using up a portion of the allowable floodway surcharge. These fills include a large fill on the left bank downstream of Union Hill Road, a fill on the right bank between Union Hill Road and the Avondale Road Extension, the roadway fill of the Avondale Road Extension, and a large fill on the left bank upstream of the Avondale Road Extension to the north side of Union Hill Road. Similarly, several bridges have been replaced with large structures subsequent to the previous hydraulic analysis, tending to lower water-surface elevations for the same discharges. Based on NFIP regulations, target water-surface elevations for the floodway runs were based on a 1'0" surcharge above baseline conditions at the time of the previous study of 1978.

The second factor complicating the floodway analysis is that the current hydraulic modeling shows significant deviations from the computed 100-year water-surface elevations reported in the previous study, particularly in the reach below the confluence with Evans Creek. Some of the difference results from the modifications to the floodplain described above. However, further investigation showed that the greatest portion of the difference is a result of the selection and application of the hydraulic model. The previous study analysis was performed with the COE, Seattle District, step-backwater model (1983) using a total of six channel cross sections and one bridge to define the reach between State Route 202 and the confluence of Bear and Evans Creeks. In contrast, the restudy uses the COE HEC-2 model and a total of 30 channel cross sections and four bridges in this reach.

A third factor complicating the floodway analysis was that HEC-2 is unable to use the split-flow option and automatic floodway encroachment options together. This necessitated the construction of a model of the existing condition with the split flow removed (a pseudo 100-year flood model) as the basis for the floodway runs. Finally, although the automated encroachment option in HEC-2 is designed to meet target water-surface elevations at each cross section, there are cases where the model does not limit the surcharge to the desired elevation or results in an unusual floodway shape. Therefore, the floodway model runs were performed in the following manner:

- A baseline HEC-2 model was configured corresponding to the 1978 conditions using recent channel survey data with the overbanks modified to remove fills and bridge modifications that have occurred since 1978. This model was run to determine appropriate regulatory BFEs.

- Target floodway elevations were computed as the regulatory BFEs plus 1'0".

- A floodway HEC-2 model was configured to reproduce results of the existing condition 100-year profile while eliminating the split-flow cards. This model was run using only the flow in the main channel (minus the portion that had previously been computed as split flow)

- to develop a pseudo 100-year profile that provided HEC-2 with a basis for the automatic encroachment run.

- A second profile was run using the floodway model with the full 100-year discharge and the equal-conveyance reduction encroachment option (HEC-2 method 4). Target surcharges as established using the 1978 baseline model were input for this model run.

- The floodway model was revised iteratively using manual encroachments (HEC-2 method 1) to meet surcharge targets (regulatory BFEs plus 1'0") and provide a reasonably shaped floodway.

Using the final HEC-2 floodway model, floodway widths were computed at each cross section. Between cross sections, the floodway boundaries were interpolated. As a result of the restudy, Table 4, "Floodway Data," was revised. The "Regulatory" and "Without Floodway" elevations are based on existing conditions. The surcharge is the difference between the existing "With Floodway" elevation and the 100-year water-surface elevation using the 1978 baseline model. Flood Profile Panels for Bear and Evans Creeks were revised as a result of the restudy.

The hydrologic and hydraulic analyses for the restudy along the South Fork Skykomish and Middle and North Fork Snoqualmie Rivers and Tate Creek were performed by Harper Reghellis, Inc., Portland, Oregon, for the KCSWM.

This study revises the detailed analyses of the South Fork Skykomish River through the Town of Skykomish and incorporates new detailed analyses affecting King County for reaches extending downstream and upstream of Skykomish. The study area begins at the county line for Snohomish and King Counties and extends 13 miles upstream nearly to the confluence of the Tye and Foss Rivers. The initial CCO meeting was held on April 6, 1995, and attended by representatives of FEMA, the consultant, and the community. The information for this study supersedes the data presented for the South Fork Skykomish River through the Town of Skykomish.

This study includes detailed analyses of a 3.9-river-mile reach of the Middle Fork Snoqualmie River and revises detailed analyses and includes new detailed analyses affecting King County. The study area begins approximately 0.35 mile downstream of the Mount Si Road bridge. The initial CCO meeting was held on January 24, 1995, and attended by representatives of FEMA, the consultant, and the community.

This study includes detailed analyses for the North Fork Snoqualmie River upstream from its mouth for a distance of 2.41 miles affecting King County, revising previous effective detailed analyses and adding new detailed analyses in the upstream reaches of the study area.

The peak discharge-frequency relationships for the reach of the South Fork Skykomish River below the confluence with Beckler Creek were developed using a statistical analysis of the stream-gage data from the Index, Washington, gage (No. 12133000). This gage has a total of 74 records for the water years ranging from 1897 through 1982. The hydrologic analysis for the South Fork Skykomish River upstream of the confluence with Beckler Creek was based on the annual peak-flow data from the Skykomish, Washington, gage (No. 12130500), with 26 years of record from water years 1930 through 1970. The floodplain boundaries along the South Fork Skykomish River in Snohomish County are based on an approximate study and do not match those from the detailed study in King County at the county line.

The hydrologic analysis for the Middle Fork Snoqualmie River was based on flow rates from the previous effective FEMA study.

The hydrologic analysis for the North Fork Snoqualmie River was based on peak-flow gage data on the river from the gages near North Bend, Washington (No. 12143000), and Snoqualmie Falls, Washington (No. 12142000). The North Bend gage includes 43 records from 1909 to 1978. The Snoqualmie Falls gage includes 61 peak records from 1930 to 1992.

The revised peak discharges for the South Fork Skykomish and North Fork Snoqualmie Rivers are shown in Table 1, "Summary of Discharges."

The cross-section data for the study along the South Fork Skykomish, Middle Fork Snoqualmie, and North Fork Snoqualmie Rivers were taken from field surveys and topographic mapping prepared by David C. Smith and Associates, Inc. The water-surface elevations of the floods of the selected recurrence intervals were computed using HEC-2. The 100-year floodplain boundary was delineated using the water-surface elevation determined at each cross section. Between cross sections, the 100-year floodplain was interpolated using topographic mapping at a scale of 1:2,400, with contour intervals of 2 and 10 feet. Flood profiles for the Middle Fork Snoqualmie River were calibrated using high-water marks at the Mount Si Road bridge.

Channel and overbank roughness factors (Manning's "n") used in the hydraulic analyses were based on engineering judgment. The range of channel roughness factors of 0.038 to 0.048 and overbank roughness factors of 0.080 to 0.120 were used to model the South Fork Skykomish River. The hydraulic profile for the Middle Fork Snoqualmie River was generally calibrated to a known flood-stage water-surface elevation (at the bridge where a high-water mark was identified). The estimated roughness coefficients for this study were adjusted to attain a relatively close elevation match to known high-water marks. The range of channel roughness factors of 0.035 to 0.046 and overbank roughness factors of 0.070 to 0.100 were used to model the North Fork Snoqualmie River.

The floodway was determined based on equal-conveyance reduction from both sides of the floodplain. Floodway widths were determined at each cross section, and between cross sections the floodway boundaries were interpolated. In cases where the floodway line is collinear with the 100-year floodplain line, only the floodway line has been shown.

The approximate analyses for Tate Creek were based on a range of calculated peak flows used to determine typical flow depths and widths for various cross sections. The delineation of the 100-year flood boundary was based on field observation of the entire length of the study reach, topographic maps, and calculated typical flow depths and widths.

10.5 Fifth Revision

This study was revised on November 8, 1999, to incorporate the Flood Insurance Study information and data for the City of Bothell into the Flood Insurance Study report for King County, Washington and Incorporated Areas. The City of Bothell is located in the Puget Sound region of northwestern Washington, approximately 3.5 miles northeast of the City of Seattle. The City of Bothell is a bi-county community within King and Snohomish Counties. Because the Flood Insurance Rate Map and Flood Insurance Study report for Snohomish County, Washington and Incorporated Areas is being published in a countywide format (Reference 118), the portions of the City of Bothell that lie within King County are included on the Flood Insurance Rate Map for King County, and the portions of the City of Bothell that lie within Snohomish County are included on the Flood Insurance Rate Map for Snohomish County.

North Creek was revised to incorporate the results of detailed hydrologic and hydraulic analyses performed by the Northwest Hydraulic Consultants, Inc., (NHC), for FEMA, under Contract No. EMW-93-C-4152. This work was completed in April 1994.

The initial CCO meeting was held on September 21, 1993, and attended by representatives of FEMA and NHC. To acquire information for this revision, NHC contacted the Public Works Department of the City of Bothell; the Surface Water Management Division of Snohomish County; Montgomery Water Group, Inc.; Quadrant Company; Alderwood Water District; Bush, Roed and Hitchings; and the U.S. Army Corps of Engineers (USACE).

The reach of North Creek that was studied for this revision extends approximately 1,000 feet upstream from the North Creek Parkway to the King-Snohomish County line at 205th Street.

Peak discharge-frequency relationships for the revised reach of North Creek were determined from the hydrologic computer model developed for the original study of North Creek using the U.S. Environmental Protection Agency HSPF model (Reference 119). For the original study, the North Creek HSPF model was run with 39 years of 15-minute rainfall and daily evaporation to develop flood-frequency curves. The resulting 39-year time series of simulated North Creek stream flows were used to create 39 years of annual instantaneous peak flow data at four locations along the study reach. A Log-Pearson Type III distribution was fitted to the annual peaks using the procedures of Water Resources Council Bulletin 17B, and the magnitudes of flows with return periods of 10, 50, 100, and 500 years were determined.

The hydraulic analyses for the revised study were performed using the USACE HEC-2 computer program (Reference 97). The physical geometry of the North Creek channel was represented by 39 cross-sections surveyed by NHC between December 1993 and February 1994. Only the channel portion of each section was surveyed. The cross-sections were extended to include the floodplain using 2-foot-contour-interval mapping provided by the City of Bothell Department of Public Works (Reference 120) and the Quadrant

Company. The HEC-2 model contains the surveyed sections as well as sections synthesized from the survey data to define the characteristics of bridges and complex study areas.

The starting water-surface elevations were determined from the flood profiles computed for the original study for the 10-, 50-, and 100-year events. The 500-year flood profile was not computed for the previous study due to complex hydraulic conditions downstream of the County line. Therefore, the starting water-surface elevation for the 500-year event was determined based on normal depth.

Channel roughness coefficients (Manning's "n" values) used in the HEC-2 model were determined by calibrating the model to conditions observed in the field on December 10, 1993. The December 10 calibration event generally stayed within the channel banks. Therefore, floodplain "n" values were estimated using engineering judgment and reference to classical publications (References 98 and 99). The final calibrated "n" values for North Creek are shown in Table 3, "Manning's "n" Values."

Twelve bridges are represented in the HEC-2 model for the revised reach of North Creek. The data used to define these structures were obtained during NHC field surveys. No other permanent structures were identified that would significantly affect flood levels.

Downstream of the King-Snohomish County line, North Creek is confined between levees. At the County line, tieback levees have been constructed across both the left and right floodplains to direct upstream flow into the North Creek channel. Just upstream of the County line, in the Monte Villa Center development, a setback levee parallels the channel to the east. At the County line, it connects to the downstream levee. At its upstream end, it tapers into higher ground near 240th Street Southeast.

The 100- and 500-year floodplain boundaries were 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"=200', with a contour interval of 2 feet (Reference 121).

Two small streams were identified for study by approximate methods. These were Horse Creek, which was studied from the confluence with the Sammamish River to the Bothell corporate limits, and an unnamed creek that flows north along 96th Avenue Northeast from the Sammamish River for approximately 0.5 mile upstream. Horse Creek originates in a steep, wooded gully near the northern corporate limits and drains approximately 1 square mile. It flows through downtown Bothell in a series of culverts, ditches, and closed pipes. The unnamed creek that flows north along 96th Avenue Northeast drains approximately 0.6 square mile of wooded area south of the Sammamish River (Reference 122).

This study has also been revised to incorporate Letters of Map Revision (LOMRs) issued on March 3, 1995 (Case Nos. 94-10-053P and 94-10-067P), and July 5, 1995 (Case No. 95-10-041P). The

March 3, 1995, LOMR revised Flood Insurance Rate Map Panel 0007 C, dated March 2, 1994, to show the effects of a private flood protection system along North Creek from just upstream of I-405 to just downstream of Monte Villa Parkway. The flood protection system comprises interconnected levees located along three separate project areas: the downstream reach of the levee system for the Quadrant Business Park project area is located along the east bank of North Creek from I-405 to 195th Street Northeast; the levee system for the Koll Business Center project area is located along the east and west banks of North Creek from 195th Street Northeast to Northeast 205th Street; and the upstream reach of the levee system for the Quadrant Monte Villa Center project area is located along the east bank of North Creek from Northeast 205th Street to Monte Villa Parkway.

The base condition HEC-2 hydraulic model (Reference 97) for North Creek was revised to reflect the levee system and new topographic information. The use of a revised base condition hydraulic model resulted in both increases and decreases in the BFEs along the revised reach of North Creek within the levee system. The BFEs decreased by 0.2 foot to 0.3 foot from approximately 400 feet upstream of I-405 to just downstream of the southernmost North Creek Parkway bridge crossing, and increased by 0.3 foot to 1.4 feet from approximately 500 feet upstream of the southernmost North Creek Parkway bridge crossing to just upstream of the northernmost North Creek Parkway bridge crossing.

The Special Flood Hazard Area (SFHA) is contained by the levee system along this reach of North Creek and, therefore, the SFHA width decreased and the areas protected from 100-year flooding by the levee system have been redesignated Zone X.

The floodway for the reach of North Creek from I-405 to 240th Street Southeast was computed based on incorporating the credited levee system and equal conveyance reduction from each side of the flooding.

The July 5 LOMR revised portions of the March 4 LOMR to revise the floodplain boundary delineations and zone designations of the base flood for the three ponded areas located just northeast of the intersection of I-405 and State Route 522 to reflect a lower BFE at the culvert under State Route 522 as computed from the revised hydraulic analysis of the Sammamish River. The zone designation of the ponding area was also changed from Zone AH to Zone A.

This restudy also incorporates changes described in a protest resolution letter dated December 15, 1998, based on data received from Ms. Lynn A. Guttmann, Director of Public Works and Community Development and Flood Program Administrator, City of Bothell, with letters dated May 6 and July 8, 1998, indicating that the placement of fill in the vicinity of the Home Depot site elevated the ground higher than the BFE. As a result, the width of the SFHA located northeast of the I-405 and State Route 522 interchange decreased.

Table 1, "Summary of Discharges"; Table 3, "Manning's "n" Values"; Table 4, "Floodway Data"; Table 5, "Community Map History"; and Exhibit 1 "Flood Profiles," were revised to reflect the results of this restudy and to incorporate the results of LOMRs and a protest resolution.

10.6 Sixth Revision

This study was revised on December 6, 2001, to incorporate the results of detailed hydrologic and hydraulic analyses of Tolt River in the Town of Carnation and the unincorporated areas of King County; and the South Fork Snoqualmie River from Interstate 90 (I-90) to approximately 4,000 feet upstream of 468th Avenue.

The hydrologic and hydraulic analyses for the Tolt River restudy were performed by Harper Righellis, Inc., Portland, Oregon, for the King County Surface Water Management Division. This work was completed in October 1996.

This restudy revises the detailed analysis of Tolt River from the confluence with Snoqualmie River through the Town of Carnation and the unincorporated areas of King County to approximately 6.5 miles upstream of the confluence. A public meeting was held September 13, 1995, to present the proposed floodplain and floodway boundaries. Representatives of King County, the City of Carnation, the consultant, Federal Emergency Management Agency (FEMA), and U.S. Army Corps of Engineers (USACE), Seattle District, attended the meeting along with about 70 residents.

The hydrologic analysis for Tolt River was based on a statistical analysis of peak-flow data from the gage near Carnation, Washington (No. 12148500). This gage has a total of 58 water years of record: 1929, 1931, and 1938 through 1993.

The hydraulic analysis was performed using the USACE HEC-2 step backwater computer program (Reference 97). Data for the cross sections were taken from field surveys performed in August through November, 1994 and from data extracted from planimetric maps. The starting water-surface elevation was obtained by the slope-area method based on an estimated slope of the energy grade. The roughness coefficients were adjusted to calibrate the hydraulic model to observed high water marks, and the range of values are shown in "Manning's "n" Values", Table 3.

From just upstream of the abandoned railroad (Snoqualmie Valley Trail) to the Holburg levee area, Tolt River is confined between levees. However, these levees do not meet FEMA freeboard requirements. Therefore, the water-surface profiles for the area affected by the levees are computed for both with and without consideration of the levees.

The 100-year floodplain boundaries for Tolt River were delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2,400, with a contour interval of 2 feet (Reference 123).

All elevations are referenced to National Geodetic Vertical Datum of 1929 (NGVD). To convert from NGVD to North American Vertical Datum of 1988 (NAVD) for the Tolt River information, add 3.58 feet to the NGVD elevations.

The hydrologic and hydraulic analyses for the South Fork Snoqualmie River were performed by the USACE, Seattle District, for FEMA, under Interagency Agreement EMW-97-IA-0140, Project Order No. 1. The work was completed in December 1998. The USACE restudy covers the mainstem of the Snoqualmie River from Meadowbrook Bridge to the confluence of the Middle and South Fork. The hydraulic analysis of the South Fork Snoqualmie River upstream of I-90 was initially performed by Harper Righellis, Inc., Portland, Oregon, for the King County Surface Water Management Division. The data prepared by Harper Righellis were incorporated into the analysis performed by the USACE and revised where necessary.

The USACE restudy was requested because the USACE, Seattle District, determined that the levees on the South Fork do not meet FEMA's current standards for providing protection from the 100-year flood.

Hydrologic analysis records for the various gages on the Snoqualmie River system were intermittent. Missing data in the intermittent records were synthetically reconstituted using the USACE Regional Frequency computer program HEC-REGFRQ (Reference 124). This program fills in and extends the records for all gages using flow data at nearby long-record stations. All stations above the Snoqualmie near Carnation station were included in the initial HEC-REGFRQ analysis. This initial HEC-REGFRQ analysis significantly improved the station statistics (primarily the regression coefficient and equivalent record length) for all stations except the Snoqualmie near Snoqualmie gage. Therefore, this station was eliminated from the analysis and the final HEC-REGFRQ analysis included only the gages on the South Fork. The reconstituted period of record for these gages was 89 years, from approximately 1909 to 1997.

A two-station comparison with the long-term gage at Carnation was used to extend the record for the short-term gage at Snoqualmie near Snoqualmie.

Log-Pearson Type III frequency curves were computed for all the gages with the USACE Flood Frequency Analysis computer program HEC-FFA (Reference 125) using the reconstituted HEC-REGFRQ data as input for the gages on the North, Middle and South Forks. The extended record from the two-station comparison was used as input for the gage on the mainstem of the Snoqualmie River near the City of Snoqualmie.

Discharges at locations other than the gages were computed using drainage area ratio equations with the nearest gage.

The resultant frequency curves were compared with previously published discharges in the Flood Insurance Study. With a few minor exceptions, the previously published discharges for the

South Fork gages at the City of North Bend fell within the 25% and 75% confidence limits of the newly computed frequency curves. Therefore, the previously published discharge for the North Bend station was adopted for this restudy.

Final water-surface profiles for each reach were computed using the USACE steady flow computer program HEC-RAS (Reference 126).

Topographic maps from studies completed by Harper Righellis, Inc. for the South Fork were used for this restudy (Reference 127). The topographic maps for the mainstem were prepared by the USACE by converting circa 1979 maps to the same horizontal and vertical datums (Reference 128).

Cross sections for the mainstem were converted from an HEC-2 data deck from a study currently underway by the USACE (Reference 129). Overbank portions of some of these cross sections were modified using the new topographic maps. Cross sections for the Middle Fork and the South Fork upstream of I-90 were converted from the HEC-2 data deck from a study recently completed by Harper Righellis, Inc. (Reference 130).

Data for all bridges were obtained from historic files maintained by the USACE. All bridges were field checked in 1998 to be certain there were no changes in the bridges. The hydraulic analyses for this restudy were based on unobstructed flow at bridges and culverts.

Roughness factors (Manning's "n") used in the backwater analyses were based on field observations by the USACE of the channel and overbank areas using guidelines established by U.S. Geological Survey (References 131 and 132). The range of values are shown in Table 3, "Manning's "n" Values".

Starting water-surface elevations for the mainstem were taken from the previous FIS. Starting water-surface elevations for the South Fork were based on the corresponding mainstem levels.

Since the levees on the South Fork did not meet FEMA's current standards for providing protection from the 100-year flood, "with" and "without" levee conditions were analyzed. Since there were levees on both sides of the river, the following analyses were conducted: "with both levees", "without right levee", and "without left levee".

Existing floodways were retained wherever possible. Only the mainstem met this criterion. Floodways for the Middle Fork, the Middle Fork Overflow channels, and the South Fork, were computed based on equal conveyance reduction from each side of the floodplain was returned to the existing floodway for the mainstem. The floodway for the South Fork Snoqualmie River was computed for the "without levee" condition.

All elevations shown on the Flood Insurance Rate Map, Flood Profiles, and Floodway Data table are referenced to NGVD. To convert from NGVD to NAVD for the Snoqualmie River and South Fork, add 3.58 feet to the NGVD elevations.

Table 1, "Summary of Discharges"; Table 3, "Manning's "n" Values"; Table 4, "Floodway Data"; and Exhibit 1, "Flood Profiles," were revised to reflect the results of this restudy.

10.7 Seventh Revision

This Flood Insurance Study (FIS) was revised on April 19, 2005, to incorporate the results of revised hydraulic analysis of Snoqualmie River main stem, South Fork and Middle Fork of the Snoqualmie River, performed by Harper Houf Righellis Inc., completed in October 2001. This revision affects the Cities of North Bend and Snoqualmie, and the unincorporated areas of King County, Washington.

In addition, this revision will incorporate the results of a revised hydrologic and hydraulic analysis of Issaquah Creek, East Fork Issaquah Creek, and Gilman Boulevard Overflow of Issaquah Creek, performed by Montgomery Water Group Inc., completed in August 2001. This revision affects the City of Issaquah, and the unincorporated areas of King County, Washington.

This revision will incorporate the results of a revised hydraulic analysis of Tibbetts Creek performed by Concept Engineering, Inc. This revision affects the City of Issaquah, and the unincorporated areas of King County, Washington.

10.7.1 Snoqualmie River Study

This restudy covers the Snoqualmie River main stem, South Fork, and Middle Fork, of the Snoqualmie River, including overflows from Middle Fork, Ribary Creek, and Gardiner Creek. The Snoqualmie River detailed study covers a reach of approximately 10 miles. The main stem Snoqualmie River study starts at the Meadow Brook bridge and extends upstream 1.5 miles to the confluence of Middle Fork and South Fork. The Middle Fork study reach extends 3.4 miles, starting from the confluence with South Fork, upstream to the Mt. Si Road bridge. The South Fork study reach extends 5 miles starting from the confluence with Middle Fork, upstream to the Interstate 90 (I-90) bridges (Reference 133).

The hydrologic analyses for this restudy were based on the U.S. Army Corps of Engineers (USACE) study completed in December 1998 that was described in Section 10.6. The hydraulic analyses were performed by Harper Houf Righellis Inc. and completed in October 2001. This restudy effort was identified in the Cooperating Technical Community Memorandum of Agreement dated September 26, 2000, between King County and FEMA.

The scope of the remapping project along the Snoqualmie River was determined at meetings attended by representatives of Cities of North Bend and Snoqualmie and King County on March 29, May 1, May 31, and September 26, 2000.

Regulatory floodways were computed for all studied reaches of the Snoqualmie River; however, only the 100-year flood event was analyzed for Ribary Creek and Gardiner Creek.

The results of the restudy were reviewed at the final Consultation Coordination Officer (CCO) meeting held on June 16, 2003. All problems raised at that meeting have been addressed in this restudy.

Hydrologic Analyses

Hydrologic analyses were performed to establish peak discharge-frequency relationships for each flooding source affecting the communities that was studied by detailed methods.

The peak flows used in the steady-state analysis for the three forks of the Snoqualmie River were derived from values previously accepted by FEMA, based on the hydrologic analyses performed by the USACE, Seattle District, for South Fork, as described in Section 10.6.

The peak flows for Gardiner Creek and Ribary Creek were not based on runoff from their catchments, both of which are 1.3 square miles, but rather from an overflow of South Fork through an assumed breach in the left levee. At the downstream end, the 100-year discharge for Ribary Creek used for this restudy is 2,675 cubic-feet-per-second (cfs), which is the combined South Fork overflow and the Ribary Creek flow. At the upstream end, the combined South Fork overflow and the Ribary Creek peak flow is 2,950 cfs. The Gardiner Creek 100-year discharge at the downstream end is 575 cfs, which combines Gardiner Creek, South Fork, and the Ribary Creek split flow. The Gardiner Creek split of the combined South Fork overflow and Ribary Creek flow is 275 cfs (Reference 134). Discharges are shown in tabular format in Table 1.

Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the studied sources were performed to provide estimates of the elevations of floods of the 10-, 50-, 100-, and 500-year recurrence intervals. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles (Exhibit 1) or in the Floodway Data Table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

The prior USACE hydraulic analyses were reviewed in detail, and appropriate revisions were made. The revisions include updating some cross sections based on more recent channel surveys and modifying the effective limits of flow, roughness coefficients, expansion and contraction coefficients, peak flows, and starting condition methods.

Water-surface elevations (WSELs) for the 100-year flood on the Snoqualmie River, Ribary Creek, and Gardiner Creek were computed using the USACE Hydrologic Engineering Center River Analysis System (HEC-RAS Version 2.2 Reference 135), step-backwater computer program.

Because the Middle Fork and South Fork peak flows are near coincident, all the hydraulic analysis models assume coincident peak flows; therefore, the starting condition for each model is the WSEL of the appropriate cross section of the downstream model. The main stem model starting WSEL was taken from the FEMA published WSELs. The overflow values from Middle Fork to South Fork were estimated using engineering judgment based on the terrain, because cross sections were not available at the split location to yield a more precise computation. The Gardiner Creek and Ribary Creek starting WSELs were based on a known WSEL at the downstream end.

Roughness coefficients (Manning's "n") values for South Fork Snoqualmie River, Snoqualmie River main stem, Middle Fork Snoqualmie River-Overflows, Gardiner Creek, and Ribary Creek are shown in Table 3.

Ribary Creek detailed study elevations were superseded by the elevations of South Fork using the "without levee" analysis. The floodplain delineation at the confluence of Gardiner Creek with South Fork was based on the South Fork model.

Because the levees on South Fork, beginning at the I-90 bridge and extending downstream to the Snoqualmie Valley Trailbridge, did not meet FEMA's standards for providing protection from the 100-year flood, "with levee" and "without levee" conditions were analyzed. To reflect the levees on both sides of the river, the following analyses were conducted: "with both levee", "without right levee", "without left levee."

The regulatory floodway along the Snoqualmie River study reach was determined using the equal-conveyance reduction option in the HEC-RAS backwater model from each side of the floodplain.

The Floodway Data Table and the FIRM show the results of the floodway computations for the studied reach of the Snoqualmie River.

The boundaries of the area inundated by the 100-year flood were plotted on U.S. Geological Survey (USGS) 1:24,000-scale Digital Raster Graphics (DRGs) enlarged to 1:2,400 (Reference 136). Topographic data, roads, and canals on the DRGs; recent aerial photographs; and field observations were reviewed to aid in plotting the flood boundaries between cross sections. Inundated areas with little or no flow were identified. More precise data on the extent of inundation may be determined at any given location by using the computed WSEL and detailed field surveys of the land surface.

For this restudy, all elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). A conversion factor of 3.6 feet was determined using the VERTCON program (Reference 137). To convert elevations from NGVD to

North American Vertical Datum of 1988 (NAVD), add 3.6 feet to the NGVD levations shown. To obtain up-to-date elevation information on National Geodetic Survey's (NGS) Elevation Reference Marks (ERMs) shown on the FIRM, please contact the Information Services Branch of the NGS at (301) 713-3242 or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

The National Flood Insurance Program (NFIP) encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 100-year floodplain data, which may include a combination of the following: 10-, 50-, 100-, and 500-year flood elevations; delineations of the 100- and 500-year floodplains; and the 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including the Flood Profiles, Floodway Data tables, and the Summary of Discharges table. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

10.7.2 Issaquah Creek Study

The Issaquah Creek detailed study reaches cover approximately 6.3 miles. Issaquah Creek was studied from the northern corporate limit of the City of Issaquah in Lake Sammamish State Park, to the southern corporate limit, for a reach of approximately 4.7 miles. East Fork Issaquah Creek (East Fork) was studied from the confluence with Issaquah Creek upstream approximately 1.0 mile to I-90. The Gilman Boulevard Overflow of Issaquah Creek was studied from the point of overflow from Issaquah Creek to its confluence with Tributary 0170 approximately 0.6 mile downstream.

The scope of the re-mapping project for the flooding on Issaquah Creek was determined at meetings attended by representatives of the City of Issaquah, King County, and FEMA, on January 12 and March 28, 2000.

Regulatory Floodways were computed for all studied reaches of Issaquah Creek, including East Fork.

The results of the restudy were reviewed at the final CCO meeting held on January 8, 2003. All problems raised at that meeting have been addressed in this restudy.

<u>Hydrologic Analyses</u>

Hydrologic analyses were performed to establish updated recurrence interval peak discharge estimates for Issaquah Creek and East Fork (Reference 138). For those flooding sources being restudied or that are extensions of previous detailed riverine studies, peak discharge results presented in the previous FIS for King County and in the Issaquah Creek Basin Plan (Reference 139) were compared to updated estimated discharges to determine appropriate values for this revised study. The peak discharge estimates assume that existing basin hydraulic structures remain unobstructed and that existing upstream dams or impoundment structures remain intact, with no changes in operating characteristics.

Discharge-frequency analysis in this revised study for Issaquah Creek and East Fork were performed as described in the hydrologic memorandum completed for this study (Reference 138). The Flood Flow Frequency Analysis computer program HEC-FFA (Reference 140) was used to determine the discharge-frequency relationships by applying log-Pearson Type III analysis techniques, in accordance with methods presented in the USGS publication *Guidelines for Determining Flood Flow Frequency, Bulletin 17B* (Reference 141) to the annual peak flow data for the gage sites.

The resulting flood flow frequency results for the Issaquah Creek gages and reported/adjusted periods of record were compared to previously published flood flow frequency values. In accordance with *Bulletin 17B* guidance, a generalized skew of -0.02 was used as a HEC-FFA input parameter applicable for this region.

Flood flow frequency analyses also were completed for the period 1964-75 in an attempt to validate the published FEMA record. The computed 100-year peak flow result was much lower (2,990 cfs) than the 100-year peak flow previously published (4,700 cfs). The expected probability estimate of 3,410 cfs was also considerably lower.

The revised flood flow frequencies were used because the difference compared to the previous flood flow frequencies was statistically significant. The updated flood flow frequency results computed at Gage 12121600 were adopted for the FIS restudy. (The actual record used was for the period 1964-99 with some updates and was based on no loss of flow from Issaquah Creek.)

Flood flow frequency on East Fork could not be analyzed directly because of the limited stream gage record. Therefore, confidence limits could not be computed to measure against the standard FEMA criteria for acceptance of prior or new flood flow estimates. Considering the similarities in peak flow between the King County Basin Plan Modeling Results (for existing conditions) and the flood flows estimated from gage transfer (using USGS gage 12120600), the higher of those two flow estimates was adopted. Additional documentation of the hydrologic analysis procedures and results are found in the hydrologic analysis memorandum (Reference 138).

Discharge-frequency relationships established for gage locations on the creeks were transferred to selected runoff concentration points along the study reaches through the application of standard USGS methods for transfer of peak flow records (Reference 142).

An analysis of streambank overflows was conducted at five locations along Issaquah Creek (Reference 143). On Issaquah Creek, recurrence interval overflows were taken into account to establish peak flow estimates for downstream reaches. Overflows are located at the Pickering reach, two places along the Gilman reach, the Dogwood Street bridge, and the Newport Way bridge. An overflow path upstream of Gilman Boulevard was rated, and a separate overflow model was developed that extends approximately 0.6 mile downstream (northwest) of the main channel.

Two overflow paths were identified on East Fork, one located on the west bank upstream of the Dogwood Street bridge and one located on the east bank between the Dogwood Street bridge and the Crescent Drive footbridge. The discharges for the streams studied by detailed methods are shown in Table 1, "Summary of Discharges." However, the following estimates account for current loss of flows upstream and downstream of Gilman Boulevard.

Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were performed to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables 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 and bridge data for the backwater analysis on Issaquah Creek and East Fork were field surveyed in April and May 2000 and February 2001 to obtain invert elevations and other hydraulic parameters. To define overbank areas and areas in-between cross-sections, these data were supplemented with City of Issaquah digital mapping with a contour interval of 2 feet from Nies based on a March 1988 aerial survey. High-water mark data based on community input were also field surveyed as part of this study.

WSELs of floods of the selected recurrence intervals on Issaquah Creek, East Fork, and Gilman Boulevard Overflow were computed using the USACE HEC-RAS, Version 3.0.1, step-backwater computer program (Reference 144). The hydraulic analyses for this study were based on unobstructed flow. Therefore, the flood elevations shown on the profiles are considered valid only if hydraulic structures remain unobstructed, are operated properly, and do not fail.

For this restudy, all elevations are referenced to NGVD. A conversion factor of 3.6 feet was determined using the VERTCON program (Reference 137). To convert elevations from NGVD to

NAVD, add 3.6 feet to the NGVD elevations shown. To obtain up-to-date elevation information on NGS ERMs shown on the FIRM, please contact the Information Services Branch of the NGS at (301) 713-3242 or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS ERM monument elevations when using these elevations for construction or floodplain management purposes.

The starting WSELs on Issaquah Creek at the northern corporate limit of the City of Issaquah were based on previous studies. The water surface elevations published in the King County FIS closely matched the predicted elevations for this analysis at that location.

The starting WSELs on East Fork were developed through normal depth computation using the slope-area method. The regulatory WSELs were influenced by backwater from the main stem of Issaquah Creek, as shown on the Flood Profiles.

The starting WSELs of floods of the selected recurrence intervals on the Gilman Boulevard Overflow and the main stem of Issaquah Creek were set using computed WSELs at hydraulic control sections. The upper main stem starting WSEL was set at the upper fish hatchery weir control section. The Gilman Boulevard Overflow model starting WSEL was set below a culvert control section.

Channel and overbank roughness factors (Manning's "n" Values) used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the stream and floodplain areas and on hydraulic calibration of flood profiles to available high-water mark data. The February 8, 1996, flood event was used for hydraulic model calibration. Model calibration results are discussed in detail in the calibration and bridge improvement memorandum by the Montgomery Water Group (Reference 145). The range of channel and overbank "n" values for Issaquah Creek, East Fork, and the Gilman Boulevard Overflow path are listed in Table 3.

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

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS provides 100-year floodplain data, which may include a combination of the following: 10-, 50-, 100-, and 500-year flood elevations; delineations of the 100- and 500-year floodplains; and the 100-year floodway. This information is presented on the FIRM and in many components of the FIS, including Flood Profiles, Floodway Data tables, and the Summary of Discharges table. Users should reference the data presented in the FIS as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations. Overflows from Issaquah

Creek and East Fork are shown on the maps as shallow flooding zones (Zone AO) with average depths identified.

To provide a national standard without regional discrimination, the 1-percent-annual-chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied by detailed methods, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated, using digital topographic maps with contour intervals of 2 feet (Reference 146).

The 100- and 500-year floodplain boundaries are shown on the FIRM. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones AE, AH, and AO), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary is shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown because of limitations of the map scale and/or lack of detailed topographic data.

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 regulatory floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum basis for additional floodway studies.

The floodways presented in this study 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 at selected cross sections. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. The Flood Profiles, Floodway Data tables, and the FIRM show the results of the floodplain and floodway computations for the studied reaches of Issaquah Creek, including East Fork. Floodways were not computed for the Gillman Boulevard Overflow. The Gillman Boulevard Overflow area is designated on the FIRM as a breakout flow area, where the flow conveyance during the base flood must be maintained to avoid increasing downstream flood hazards in Issaquah Creek. This breakout flow area extends from the left overbank (looking downstream) of Issaquah Creek between Cross Sections M and N toward the west along Gillman Boulevard.

10.7.3 Tibbetts Creek LOMR

The LOMR issued on February 23, 2005, for the City of Issaquah and the unincorporated areas of King County, to show the hydraulic effects of the channel relocation and fill along Tibbetts Creek, was included in this update. As a result of the channel relocation, fill and more detailed topographic information, the Flood Insurance Rate Map, Flood profiles, and Floodway Data Tables were revised to modify elevations, floodway data, and floodplain and floodway boundary delineations along Tibbetts Creek from approximately 150 feet upstream of Interstate Highway 90 (eastbound) to approximately 700 feet downstream of Newport Way Northwest.