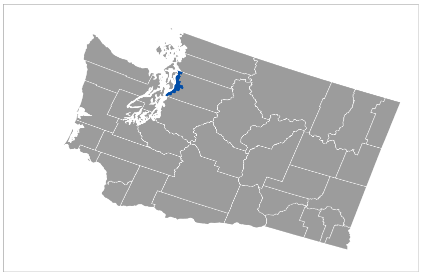
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3



SNOHOMISH COUNTY, WASHINGTON

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER	COMMUNITY NAME	COMMUNITY NUMBER
CITY OF ARLINGTON	530271	CITY OF MILL CREEK	530330
CITY OF BOTHELL	530075	CITY OF MONROE	530169
CITY OF BRIER	530276	CITY OF MOUNTLAKE TERRACE	530170
TOWN OF DARRINGTON	530233	CITY OF MUKILTEO	530235
CITY OF EDMONDS	530163	CITY OF SNOHOMISH	530171
CITY OF EVERETT	530164	SNOHOMISH COUNTY	535534
CITY OF GOLD BAR	530285	(UNINCORPORATED AREAS)	
TOWN OF GRANITE FALLS	530287	CITY OF STANWOOD	530172
TOWN OF INDEX	530166	STILLAGUAMISH TRIBE	530238
CITY OF LAKE STEVENS	530291	CITY OF SULTAN	530173
CITY OF LYNNWOOD	530167	TULALIP TRIBE	530225
CITY OF MARYSVILLE	530168	TOWN OF WOODWAY	530308

FEMA

MAP REVISED: REVISED PRELIMINARY 7/22/2016

FLOOD INSURANCE STUDY NUMBER
53061CV001B

Version Number 2.3.2.1

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FLOOD INSURANCE STUDY REPORT
SNOHOMISH COUNTY, WASHINGTON

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as “Post-FIRM” buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community’s regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Snohomish County, Washington.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
CITY OF ARLINGTON	530271	17110008 17110011	53061C0380F, 53061C0384F, 53061C0390F, 53061C0391F, 53061C0392F, 53061C0395F*, 53061C0405F, 53061C0415F	N/A
CITY OF BOTHELL	530075	17110012	53061C1330F, 53061C1335F, 53061C1336F*, 53061C1337F, 53061C1338F, 53061C1339F, 53061C1343F, 53061C1345F	N/A
CITY OF BRIER	530276	17110012	53061C1317F, 53061C1319F, 53061C1320F	N/A
TOWN OF DARRINGTON	530233	17110006 17110008	53061C0188F, 53061C0189F, 53061C0501F, 53061C0502F	N/A
CITY OF EDMONDS	530163	17110012 17110019	53061C1285F, 53061C1292F, 53061C1294F, 53061C1305F, 53061C1315F	N/A
CITY OF EVERETT	530164	17110009 17110011 17110012 17110019	53061C0715G, 53061C0716G, 53061C0720G, 53061C1010F, 53061C1020F 53061C1030G, 53061C1035G, 53061C1040G, 53061C1045G, 53061C1100F, 53061C1125F	N/A
CITY OF GOLD BAR	530285	17110009	53061C1427F, 53061C1431F, 53061C1435F	N/A
TOWN OF GRANITE FALLS	530287	17110008 17110011	53061C0755F	N/A
TOWN OF INDEX	530166	17110009	53061C1454F, 53061C1458F	N/A
CITY OF LAKE STEVENS	530291	17110011	53061C0720G, 53061C0737F, 53061C0738F, 53061C0739F, 53061C0743F, 53061C0745F, 53061C1035G, 53061C1055G	N/A
CITY OF LYNNWOOD	530167	17110012 17110019	53061C1305F, 53061C1309F, 53061C1310F, 53061C1315F, 53061C1320F	N/A

*Panel Not Printed

Table 1: Listing of NFIP Jurisdictions *(continued)*

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
CITY OF MARYSVILLE	530168	17110008 17110011	53061C0370F, 53061C0390F, 53061C0395F*, 53061C0708F, 53061C0709F, 53061C0710F, 53061C0716G, 53061C0717G, 53061C0728F, 53061C0736F	N/A
CITY OF MILL CREEK	530330	17110012	53061C1040G, 53061C1045G, 53061C1330F, 53061C1335F	N/A
CITY OF MONROE	530169	17110009 17110011	53061C1070G, 53061C1100F, 53061C1357G, 53061C1360G, 53061C1376G, 53061C1377G, 53061C1380F	N/A
CITY OF MOUNTLAKE TERRACE	530170	17110012	53061C1315F, 53061C1320F	N/A
CITY OF MUKILTEO	530235	17110012 17110019	53061C1010F, 53061C1015F, 53061C1020F, 53061C1310F	N/A
CITY OF SNOHOMISH	530171	17110011	53061C0775F, 53061C1055G, 53061C1061G, 53061C1062G, 53061C1065G	N/A

*Panel Not Printed

Table 1: Listing of NFIP Jurisdictions *(continued)*

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
SNOHOMISH COUNTY (UNINCORPORATED AREAS)	535534	17110006 17110007 17110008 17110009 17110010 17110011 17110012 17110019	53061C0020F, 53061C0025F, 53061C0040F, 53061C0045F*, 53061C0065F*, 53061C0075F*, 53061C0090F, 53061C0095F, 53061C0115F, 53061C0120F, 53061C0140F, 53061C0145F, 53061C0165F, 53061C0170F, 53061C0188F, 53061C0189F, 53061C0190F, 53061C0195F, 53061C0225F, 53061C0250F 53061C0275F, 53061C0300F, 53061C0325F*,53061C0332F, 53061C0335F, 53061C0345F, 53061C0351F, 53061C0352F, 53061C0355F, 53061C0360F, 53061C0365F, 53061C0370F, 53061C0380F, 53061C0384F, 53061C0385F, 53061C0390F, 53061C0391F, 53061C0392F, 53061C0395F*, 53061C0405F, 53061C0410F, 53061C0415F, 53061C0420F, 53061C0445F, 53061C0450F, 53061C0465F, 53061C0475F*, 53061C0500F, 53061C0501F, 53061C0502F, 53061C0525F, 53061C0550F, 53061C0575F, 53061C0600F, 53061C0625F*,53061C0650F*, 53061C0675F, 53061C0695F, 53061C0700F, 53061C0705F*, 53061C0708F, 53061C0709F, 53061C0710F, 53061C0715G, 53061C0716G, 53061C0717G, 53061C0720G, 53061C0728F, 53061C0730F, 53061C0735F, 53061C0736F, 53061C0737F, 53061C0738F, 53061C0739F, 53061C0743F, 53061C0745F, 53061C0755F, 53061C0760F, 53061C0775F, 53061C0780F, 53061C0785F, 53061C0800F*, 53061C0805F, 53061C0825F, 53061C0850F, 53061C0875F, 53061C0900F, 53061C0925F*, 53061C0950F*, 53061C0975F*, 53061C1000F*, 53061C1005F, 53061C1010F, 53061C1015F, 53061C1020F, 53061C1030G, 53061C1035G, 53061C1040G, 53061C1045G, 53061C1055G, 53061C1060F, 53061C1061G, 53061C1062G, 53061C1065G, 53061C1070G, 53061C1100F, 53061C1114F, 53061C1125F, 53061C1150F, 53061C1175F, 53061C1200F, 53061C01225F, 53061C1250F*, 53061C1275F*, 53061C1285F, 53061C1292F, 53061C1294F, 53061C1300F, 53061C1305F, 53061C1309F,	N/A

*Panel Not Printed

Table 1: Listing of NFIP Jurisdictions *(continued)*

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
SNOHOMISH COUNTY (UNINCORPORATED AREAS) (continued)	535534	17110006 17110007 17110008 17110009 17110010 17110011 17110012 17110019	53061C1310F, 53061C1315F, 53061C1317F, 53061C1319F, 53061C1320F, 53061C1330F, 53061C1335F, 53061C1336F*, 53061C1337F, 53061C1338F, 53061C1343F, 53061C1345F, 53061C1355G, 53061C1357G, 53061C1360G, 53061C1365F, 53061C1370F, 53061C1376G, 53061C1377F, 53061C1380F, 53061C1385F, 53061C1390F, 53061C1395F*, 53061C1402F, 53061C1405F, 53061C1406F, 53061C1407F, 53061C1425F*, 53061C1427F, 53061C1430F, 53061C1431F, 53061C1435F, 53061C1450F*, 53061C1454F, 53061C1455F, 53061C1458F, 53061C1460F, 53061C1465F, 53061C1470F, 53061C1500F, 53061C1525F, 53061C1550F, 53061C1575F*	N/A
CITY OF STANWOOD	530172	17110008 17110019	53061C0040F, 53061C0332F, 53061C0351F, 53061C0352F, 53061C0355F	N/A
STILLAGUAMISH TRIBE	530238	17110008	53061C0115F, 53061C0380F, 53061C0384F, 53061C0385F, 53061C0390F, 53063C0395F*	N/A
CITY OF SULTAN	530173	17110009	53061C1114F, 53061C1125F, 53061C1402F, 53061C1406F, 53061C1407F	N/A
TULALIP TRIBE	53OTHR	17110011 17110019	53061C0695F, 53061C0700F, 53061C0705F*, 53061C0708F, 53061C0710F, 53061C0715G, 53061C0716G	N/A
TOWN OF WOODWAY	530308	17110019	53061C1292F, 53061C1294F, 53061C1315F	N/A

*Panel Not Printed

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 32, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for Snohomish County became effective on September 16, 2005. Refer to Table 29 for information about subsequent revisions to the FIRMs.

- Selected FIRM panels for the community may contain information (such as floodways and cross sections) that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels. 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 (shaded)
C	X (unshaded)

- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the

LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

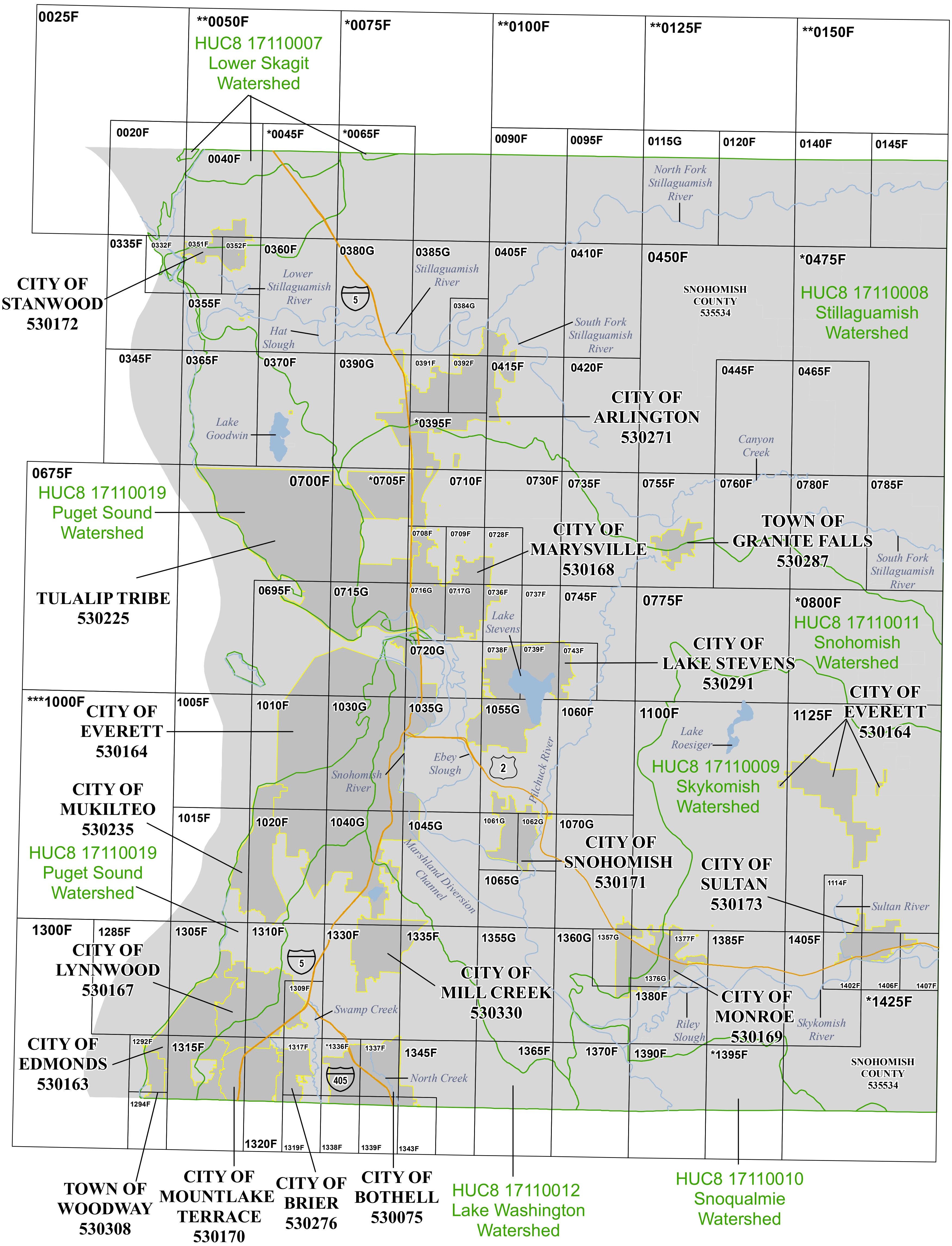
The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at http://www.fema.gov or contact your appropriate FEMA Regional Office for more information about this program.

- Previous FIS Reports and FIRMs may have included one or more levees that were accredited as reducing the risk associated with the 1-percent-annual chance flood based on the information available and the mapping standards of the NFIP at the time. For FEMA to continue to accredit the identified levee(s), the levee(s) must meet the criteria of the NFIP requirements cited in the Code of Federal Regulations at, Title 44, Chapter 1, Section 65.10 (44CFR 65.10), titled "Mapping of Areas Protected by Levee Systems." Since the status of levee(s) is subjected to change at any time, the user should contact the appropriate agency for the latest information regarding the levee(s) presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

  Please also note that FEMA has identified one or more levees in this jurisdiction that have not been demonstrated by the community or levee owner to meet the requirements of the 44CFR Part 65.10, of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. As such, there are temporary actions are being taken until such a time as FEMA is able to initiate a new flood risk project to apply new levee analysis and mapping procedures to leveed areas. These temporary actions involve using the flood hazard data shown on the previous effective FIRM exactly as shown on that prior FIRM and identifying the area with bounding lines and special map notes. If a vertical datum conversion was executed for the county, then the Base Flood Elevations shown on the FIRM will now reflect elevations referenced to the North American Vertical Datum of 1988 (NAVD88). These levees are on FIRM panels 53061C0351F, 53061C0352F, 53061C0355F, 53061C0715G, 53061C0716G, 53061C0717G, 53061C0720G, 53061C1030G, 53061C1035G, 53061C1040G, 53061C1045G, 53061C1061G, 53061C1062G, 53061C1065G, 53061C1125F, 53061C1150F, 53061C1343F, 53061C1407F, 53061C1430F on the Ebey Slough, Hat Slough, Lower Stillaguamish River, Marshland Diversion Channel, North Creek, Skykomish River, Snohomish River, Steamboat Slough, Union Slough, and Wallace River and are identified on the FIRM panels as potential areas of flood hazard data changes based on further review. Please refer to Section 4.4 of this FIS report for more information.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at http://www.fema.gov.

Figure 1: FIRM Panel Index



1 inch = 4 miles

0 2 4 8 Miles

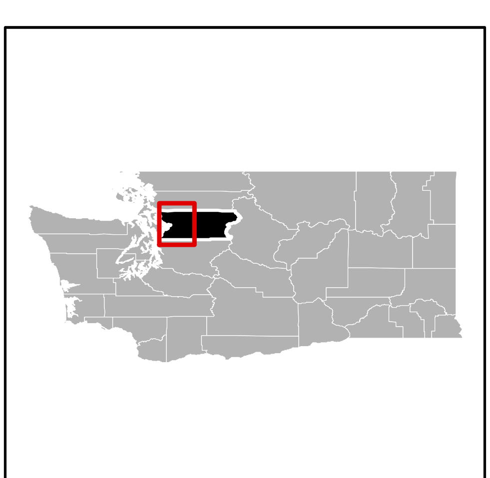
Map Projection:
State Plane Washington North FIPS 4601
North American Datum of 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FIS REPORT FOR ADDITIONAL INFORMATION

*PANEL NOT PRINTED - ALL ZONE X
**PANEL NOT PRINTED - AREA OUTSIDE COUNTY BOUNDARY
***PANEL NOT PRINTED - OPEN WATER AREA



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX (Sheet 1 of 2)

SNOHOMISH COUNTY, WASHINGTON AND INCORPORATED AREAS

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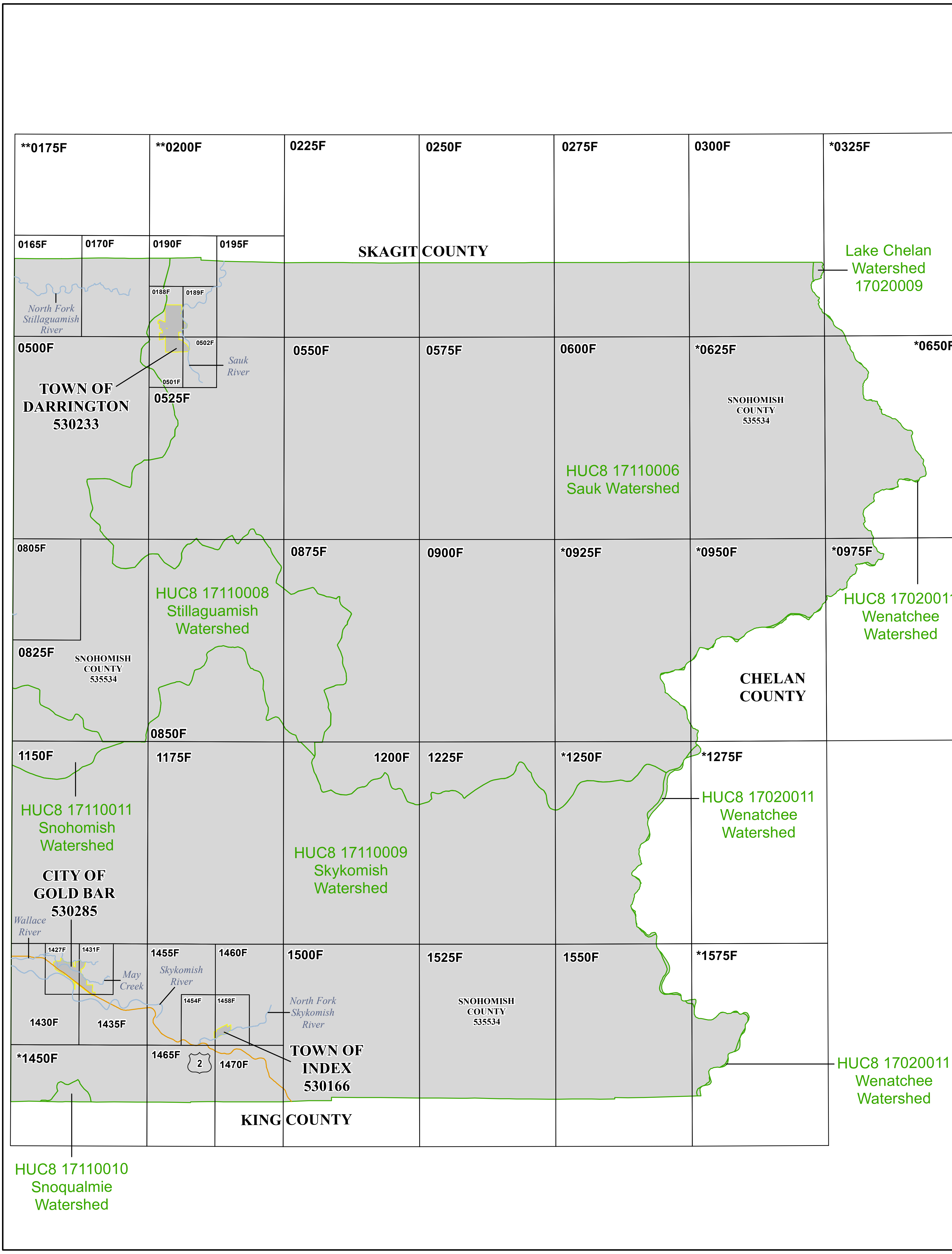
MAP NUMBER
53061CIND1B

MAP REVISED



1 inch = 4 miles

0 2 4 8 Miles

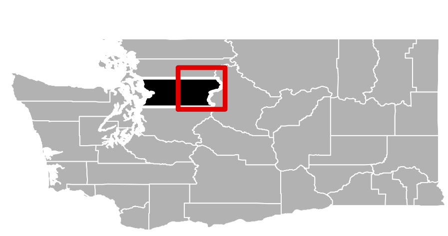
Map Projection:
State Plane Washington North FIPS 4601
North American Datum of 1983

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FIS REPORT FOR ADDITIONAL INFORMATION

*PANEL NOT PRINTED - ALL ZONE X
**PANEL NOT PRINTED - AREA OUTSIDE COUNTY BOUNDARY
***PANEL NOT PRINTED - OPEN WATER AREA



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX (Sheet 2 of 2)

SNOHOMISH COUNTY, WASHINGTON AND INCORPORATED AREAS

PANELS PRINTED:
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MAP NUMBER
53061CIND2B

MAP REVISED

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 29 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations as names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the FIS Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users *(continued)*

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was State Plane Lambert Conformal Conic, Washington South Zone. The horizontal datum was NAD83. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

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

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 32 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by the USDA-FSA Aerial Photography Field Office. This information was derived from digital orthophotography at a scale of 1:12,000 and 1-meter pixel resolution from photography dated 2009.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Snohomish County, Washington, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 29 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

Figure 2. FIRM Notes to Users *(continued)*

SPECIAL NOTES FOR SPECIFIC FIRM PANELS This Notes to Users section was created specifically for Snohomish County, Washington, effective . **PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS:** Check with your local community to obtain information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner of community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by April 15, 2018. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip/index.shtm. **ATTENTION:** The levee, dike or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure. The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.
FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone, either at cross section locations or as static whole-foot elevations that apply throughout the zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 3: Map Legend for FIRM *(continued)*

OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Zone X Protected by Accredited Levee: Areas protected by an accredited levee, dike or other flood control structures. See Notes to Users for important information.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible
NO SCREEN	Unshaded Zone X: Areas determined to be outside the 0.2% annual chance floodplain
FLOOD HAZARD AND OTHER BOUNDARY LINES	
	Flood Zone Boundary (white line)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
Aqueduct Channel Culvert Storm Sewer	Channel, Culvert, Aqueduct, or Storm Sewer
Dam Jetty Weir	Dam, Jetty, Weir
	Levee, Dike or Floodwall accredited or provisionally accredited to provide protection from the 1% annual chance flood
	Levee, Dike or Floodwall not accredited to provide protection from the 1% annual chance flood.
Bridge	Bridge

Figure 3: Map Legend for FIRM *(continued)*

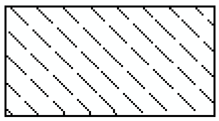
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas. See Notes to Users for important information.*	
 **CBRS AREA 09/30/2009**	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
 **OTHERWISE PROTECTED AREA 09/30/2009**	Otherwise Protected Area
REFERENCE MARKERS	
22.0 ●	River mile Markers
CROSS SECTION & TRANSECT INFORMATION	
(B)— 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
(5280)— 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
— 17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
(8) - - - - - - -	Coastal Transect
——-——	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
——--——--	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
~~ 513 ~~~~	Base Flood Elevation Line (shown for flooding sources for which no cross sections or profile are available)
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity

Figure 3: Map Legend for FIRM *(continued)*

BASE MAP FEATURES	
Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
———	Horizontal Reference Grid Line
—	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$^{42}76^{000m}E$	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Snohomish County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, “Map Legend for FIRM”, describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Snohomish County, respectively.

Table 2, “Flooding Sources Included in this FIS Report,” lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

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. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

Within this jurisdiction, there are one or more levees that have not been demonstrated by the communities or levee owners to meet the requirements of the 44CFR Part 65.10 of the NFIP regulations (44 CFR 65.10) as it relates to the levee’s capacity to provide 1-percent-annual-chance flood protection. As such, the floodplain boundaries in this area are subject to change.

Please refer to Section 4.4 of this FIS for more information on how this may affect the floodplain boundaries shown on this FIRM.

2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water-surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

The Density Fringe area is an area of high flood damage potential where conventional floodway areas cannot be established. In order to foster the continued agricultural use of prime farmlands in these flood plain areas, and maintain an acceptable level of flood hazard protection, special development criteria shall be utilized to prevent a cumulative increase in the base flood elevation of more than one foot.

The density fringe area shall consist of the following: Areas designated on the FIS for Snohomish County and Incorporated Areas, and the FIRMS and the Stillaguamish River special flood hazard area (1% Annual-Chance flood plain) located between the mouth of said river and river mile 11.1.

Except for the lower Snohomish and Sauk Rivers, the floodways presented in this study were computed on the basis of equal-conveyance reduction from each side of the floodplain.
No floodway was developed for Hat or South-Cook Sloughs or the Stillaguamish River between RM 0.0 and RM 11.1 because of the complex system of split-river channels and overland flow. Examination of the Canyon Creek floodway and 1-percent-annual-chance floodplain computations indicates that high velocities (12 to 20 feet per second) and severe bank erosion should be expected along the entire reach. Therefore, the entire Canyon Creek floodplain is considered "extremely hazardous," with the floodway designated as the area inundated by the base flood.

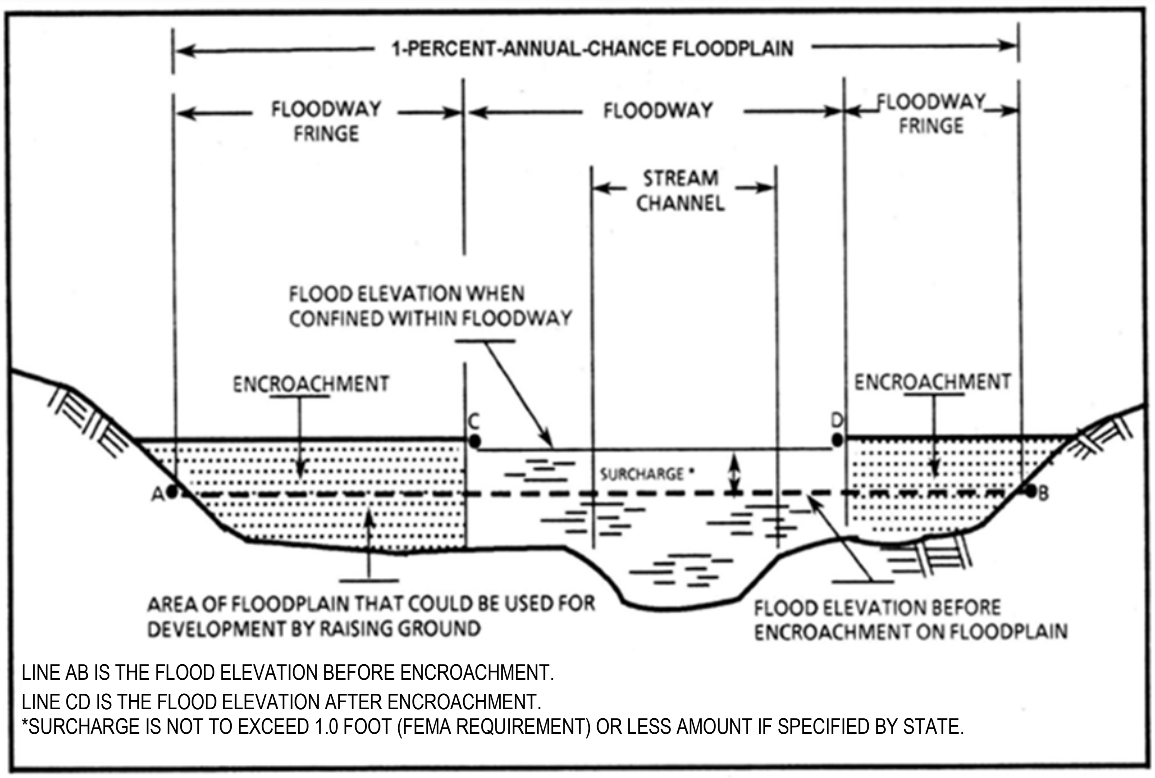
No floodway has been delineated along the Snohomish River from RM 0.00 to RM 16.62. Through agreements made with FEMA, Snohomish County is regulating this reach through methods that do not require a floodway.

The Snohomish County Planning Department, in a letter dated July 21, 1980, requested additional study of the Pilchuck River to narrow the floodway at a subdivision called the Pilchuck 26 tract, between Cross Sections J and L. More detailed definition of the topography in this area resulted in the narrowing of the floodway. The new floodway satisfies the FEMA criteria for an equal-conveyance floodway.

Similar revisions that meet the equal-conveyance-floodway criteria were made on the Skykomish River at Ironhead Park and at Twin Rivers in the City of Sultan.

The Sauk River equal-conveyance floodway was modified at Cross Sections A, B, E, H, and L to create a smooth and more realistic floodway delineation and to encompass high-water channels that are considered too dangerous to be developed.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Beckler River	Snohomish County (Unincorporated Areas)	Snohomish/King County boundary	Approximately 2.5 miles upstream of Snohomish/King County boundary	17110009	2.5	N/A	N	A	N/A
Boulder River	Snohomish County (Unincorporated Areas)	Confluence with North Fork Stillaguamish River	Approximately 3.2 miles upstream of North Fork Stillaguamish River	17110008	3.2	N/A	N	A	N/A
Canyon Creek	Snohomish County (Unincorporated Areas)	Approximately 2.9 miles upstream of Scott Paper Road	Approximately 3.9 miles upstream of Scott Paper Road	17110008	1.0	N/A	N	A	N/A
Canyon Creek	Snohomish County (Unincorporated Areas)	Approximately 1.4 miles upstream of South Fork Stillaguamish River	Approximately 2.9 miles upstream of Scott Paper Road	17110008	16.2	N/A	Y	AE	N/A
Ebey Slough	City of Marysville, Snohomish County (Unincorporated Areas), TULALIP TRIBE	Approximately 1.15 miles upstream of Interstate 5	Approximately 0.8 miles upstream of Jacknife Bridge	17110011	12.5	N/A	N	AE	2001
Ebey-Steamboat Slough Connector	Snohomish County (Unincorporated Areas)	Confluence with Steamboat Slough	Approximately 0.6 miles upstream of confluence of Steamboat Slough	17110011	0.6	N/A	N	AE	2001
Haskel Slough	Snohomish County (Unincorporated Areas)	Approximately 3.4 miles upstream of confluence with Skykomish River	Approximately 1.4 miles upstream of State Route 203 Bridge	17110009	2.3	N/A	Y	AE	N/A

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Hat Slough	Snohomish County (Unincorporated Areas)	Confluence with Port Susan	Confluence with Lower Stillaguamish River	17110008	2.4	N/A	N	AE	N/A
Lake Goodwin	Snohomish County (Unincorporated Areas)	Entire shoreline	Entire shoreline	17110019	N/A	0.8	N	A	N/A
Lake Roesiger	Snohomish County (Unincorporated Areas)	Entire shoreline	Entire shoreline	17110019	N/A	0.5	N	A	N/A
Lake Stevens	Snohomish County (Unincorporated Areas)	Entire shoreline	Entire shoreline	17110011	N/A	0.02	N	A	N/A
Lower Stillaguamish River	Snohomish County (Unincorporated Areas)	At 84th Avenue NW	Confluence of Hat Slough	17110008	4.0	N/A	N	AE	N/A
Marshland Diversion Channel	City of Everett, Snohomish County (Unincorporated Areas)	Confluence above mouth	Approximately 0.36 miles upstream of Springhetti Road	17110011	6.3	N/A	N	AE	N/A
May Creek	City of Gold Bar, Snohomish County (Unincorporated Areas)	Confluence with Wallace River	Approximately 0.45 miles upstream of 423rd Avenue SE	17110009	4.1	N/A	Y	AE	2006
North Creek	City of Bothell	Snohomish/King County boundary	At Filbert Road	17110012	3.1	N/A	Y	AE	1994

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
North Creek	City of Mill Creek, Snohomish County (Unincorporated Areas)	At Filbert Road	Approximately 6.0 miles upstream of Filbert Road	17110012	6.0	N/A	N	A	N/A
North Fork Sauk River	Snohomish County (Unincorporated Areas)	Confluence with Sauk River	Approximately 9.0 miles upstream of confluence of Sauk River	17110006	9.0	N/A	N	A	N/A
North Fork Skykomish River	Snohomish County (Unincorporated Areas)	Approximately 2.7 miles upstream of Fifth Street	Approximately 15.5 miles upstream of Fifth Street	17110009	12.8	N/A	N	A	N/A
North Fork Skykomish River	Town of Index, Snohomish County (Unincorporated Areas)	Approximately 500 feet upstream of confluence with Skykomish River	Approximately 2.7 miles upstream of Fifth Street	17110009	8.3	N/A	Y	AE	2010
North Fork Stillaguamish River	Snohomish County (Unincorporated Areas)	Confluence with Stillaguamish River	Approximately 2.8 miles upstream of confluence of Squire Creek	17110008	34.6	N/A	Y	AE	N/A
Pilchuck Creek	Snohomish County (Unincorporated Areas)	Confluence with Stillaguamish River	Approximately 4.6 miles upstream of confluence of Stillaguamish River	17110008	4.6	N/A	N	A	N/A
Pilchuck River	Snohomish County (Unincorporated Areas)	Approximately 1.0 mile upstream of 64th Street NE	Approximately 3.9 miles upstream of 64th Street NE	17110011	2.9	N/A	N	A	N/A

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Pilchuck River	Snohomish County (Unincorporated Areas)	Confluence with Snohomish River	Approximately 1.0 mile upstream of 64th Street NE	17110011	18.5	N/A	Y	AE	N/A
Port Susan	Snohomish County (Unincorporated Areas), TULALIP TRIBE	Entire shoreline	Entire shoreline	N/A	N/A	N/A	N	AE, VE	2013
Possession Sound	City of Everett, Snohomish County (Unincorporated Areas), TULALIP TRIBE	Entire shoreline	Entire shoreline	N/A	N/A	N/A	N	AE, VE	2013
Puget Sound	City of Edmonds, Town of Woodward, Snohomish County (Unincorporated Areas)	Entire shoreline	Entire shoreline	N/A	N/A	N/A	N	AE, VE	2013
Quilceda Creek	Snohomish County (Unincorporated Areas)	From mouth	Approximately 5.0 miles upstream of mouth	N/A	0.7	N/A	N	A	N/A
Rapid River	Snohomish County (Unincorporated Areas)	Confluence with Beckler River	Approximately 3.7 miles upstream of confluence of Beckler River	17110009	3.7	N/A	N	A	N/A

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Riley Slough	Snohomish County (Unincorporated Areas)	Approximately 0.4 mile upstream of confluence with Snoqualmie River	Approximately 6.1 miles upstream of confluence with Snoqualmie River	17110009	6.6	N/A	Y	AE	N/A
Sauk River	Snohomish County (Unincorporated Areas)	Approximately 3.4 miles upstream of Sauk Prairie Road	Approximately 23.4 miles upstream of Sauk Prairie Road	17110006	20.0	N/A	N	A	N/A
Sauk River	Town of Darrington, Snohomish County (Unincorporated Areas)	Approximately 0.5 miles downstream of Skagit/Snohomish County boundary	Approximately 3.4 miles upstream of Sauk Prairie Road	17110006	7.5	N/A	Y	AE	N/A
Scriber Creek	City of Brier, Snohomish County (Unincorporated Areas)	Confluence with Swamp Creek	Approximately 0.35 miles upstream of Poplar Way	17110012	1.8	N/A	N	A	N/A
Scriber Creek	City of Lynnwood, Snohomish County (Unincorporated Areas)	Approximately 0.35 miles upstream of Poplar Way	Approximately 0.2 miles upstream of 196th Street SW	17110012 17110019	1.7	N/A	N	AE	1988
Silver Lake	City of Everett	Entire shoreline	Entire shoreline	17110012	N/A	0.2	N	A	N/A
Skagit Bay	Snohomish County (Unincorporated Areas), City of Stanwood	Entire shoreline	Entire shoreline	N/A	N/A	N/A	N	AE	2013

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Skykomish River	City of Monroe, Snohomish County (Unincorporated Areas)	Confluence with Snoqualmie River	Approximately 2.5 miles upstream of confluence of Proctor Creek	17110009	26.1	N/A	Y	AE	2010
Skykomish River	Snohomish County (Unincorporated Areas)	Approximately 0.84 miles upstream of SR-522	Confluence of North and South Fork Skykomish Rivers	17110009	2.5	N/A	N	A	N/A
Snohomish River	City of Everett, Snohomish County (Unincorporated Areas)	Confluence above mouth	Approximately 0.84 miles upstream of SR-522	17110010 17110011 17110019	20.8	N/A	Y	AE	2001
Snoqualmie River	Snohomish County (Unincorporated Areas)	Confluence with Skykomish River	Snohomish/King County boundary	17110010	5.4	N/A	Y	AE	2010
South-Cook Slough	Snohomish County (Unincorporated Areas)	Convergence with Stillaguamish River	Approximately 1.52 miles upstream of State Highway 530	17110008	3.4	N/A	N	AE	N/A
South Fork Sauk River	Snohomish County (Unincorporated Areas)	Confluence with Sauk River	Approximately 8.4 miles upstream of confluence of Sauk River	17110006	8.4	N/A	N	A	N/A
South Fork Skykomish River	Snohomish County (Unincorporated Areas)	Confluence with Skykomish River	Approximately 2.5 miles upstream of confluence of Skykomish River	17110009	6.7	N/A	N	A	2010

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
South Fork Stillaguamish River	Snohomish County (Unincorporated Areas)	Approximately 5.5 miles upstream of confluence of Jims Creek	Approximately 15.1 miles upstream of Mountain Loop Highway	17110008	24	N/A	N	A	N/A
South Fork Stillaguamish River	Snohomish County (Unincorporated Areas)	Confluence with Stillaguamish River	Approximately 15.1 miles upstream of Mountain Loop Highway	17110008	20.7	N/A	Y	AE	N/A
South Fork Sultan Creek	Snohomish County (Unincorporated Areas)	Confluence with Sultan River	Approximately 2.0 miles upstream of confluence of Sultan River	17110009	2.1	N/A	N	A	N/A
Steamboat Slough	City of Everett, City of Marysville, Snohomish County (Unincorporated Areas), TULALIP TRIBE	Confluence above Possession Sound	Approximately 7.1 miles above confluence with Possession Sound	17110011	7.1	N/A	N	AE	2001
Stillaguamish River	Snohomish County (Unincorporated Areas)	Approximately 2.65 miles above confluence with Hat Slough	Confluence with North Fork Stillaguamish River and South Fork Stillaguamish River	17110008	15.1	N/A	Y	AE	N/A

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Stillaguamish River Split Flow	Snohomish County (Unincorporated Areas)	Confluence with North Fork Stillaguamish River	Approximately 3.62 miles upstream of confluence of North Fork Stillaguamish River	17110008	1.9	N/A	Y	AE	N/A
Suiattle River	Snohomish County (Unincorporated Areas)	Skagit/Snohomish County boundary	Approximately 20.9 miles upstream of Skagit/Snohomish County boundary	17110006	20.9	N/A	N	A	N/A
Sultan River	Snohomish County (Unincorporated Areas)	Approximately 1.7 miles downstream of confluence of South Fork Sultan River	Approximately 4.4 miles downstream of confluence of South Fork Sultan River	17110009	3.3	N/A	N	A	N/A
Sultan River	City of Sultan, Snohomish County (Unincorporated Areas)	Confluence with Skykomish River	Approximately 3.2 miles upstream of U.S. Highway 2	17110009	3.2	N/A	Y	AE	2010
Swamp Creek	Snohomish County (Unincorporated Areas)	Approximately 4.0 miles upstream of Magnolia Road	Approximately 7.2 miles upstream of Magnolia Road	17110012	3.2	N/A	N	A	N/A
Swamp Creek	City of Brier, Snohomish County (Unincorporated Areas)	Snohomish/King County boundary	Approximately 4.0 miles upstream of Magnolia Road	17110012	5.4	N/A	Y	AE	1986

Table 2: Flooding Sources Included in this FIS Report *(continued)*

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Union Slough	City of Everett, Snohomish County (Unincorporated Areas)	Confluence above Steamboat Slough	Approximately 4.5 miles upstream of confluence of Steamboat Slough	17110011	5.1	N/A	N	AE	2001
Wallace River	Snohomish County (Unincorporated Areas)	Confluence with Skykomish River	Approximately 0.7 miles upstream of Ley Road	17110009	7.2	N/A	Y	AE	N/A
White Chuck River	Snohomish County (Unincorporated Areas)	Confluence with Sauk River	Approximately 12.9 miles upstream of confluence of Sauk River	17110006	12.9	N/A	N	A	N/A
Woods Creek	Snohomish County (Unincorporated Areas)	Confluence with Skykomish River	Approximately 5.9 miles upstream of confluence of Skykomish River	17110009	5.5	N/A	N	A	N/A

All floodways that were developed for this FIS project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs 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 Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

Some States and communities use non-encroachment zones to manage floodplain development. While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event.

Non-encroachment determinations may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this Flood Risk Project have been tabulated for selected cross sections are shown in Table 26. “Flood Hazard and Non-Encroachment Data for Selected Streams”. Areas for which non-encroachment zones are provided shown BFEs and the 1% annual chance floodplain boundaries mapped as zone AE on the FIRM but no floodways.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this FIS project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

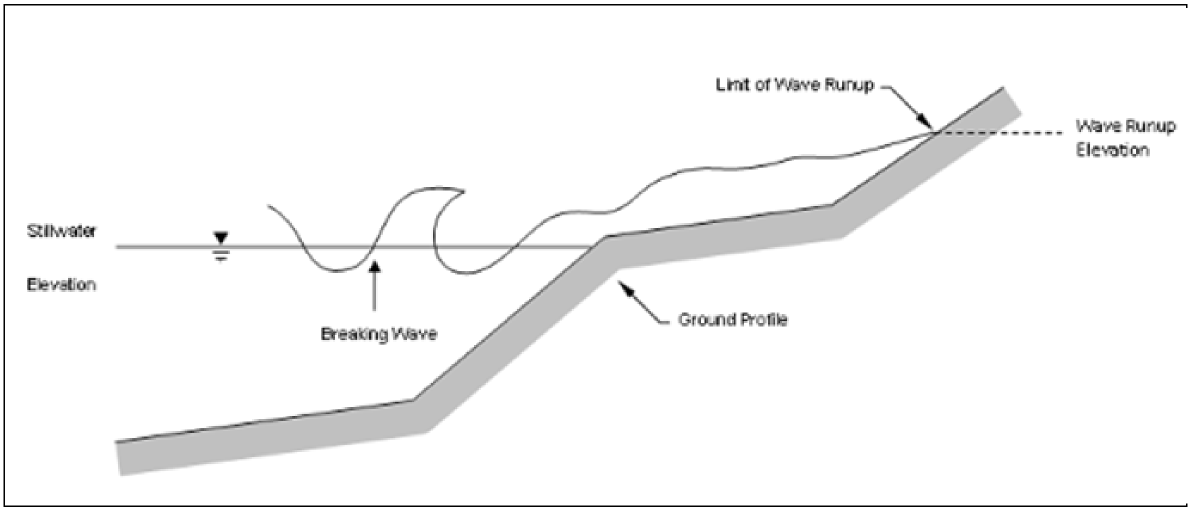
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure , "1% Annual Chance Total Stillwater Levels for Coastal Areas."

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 27 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17: Coastal Transect Parameters, “Coastal Transect Parameters.” The locations of transects are shown in Figure 9, “Transect Location Map.” More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on the specific mapping methods are provide in Section 6.4 of this FIS report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.

- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

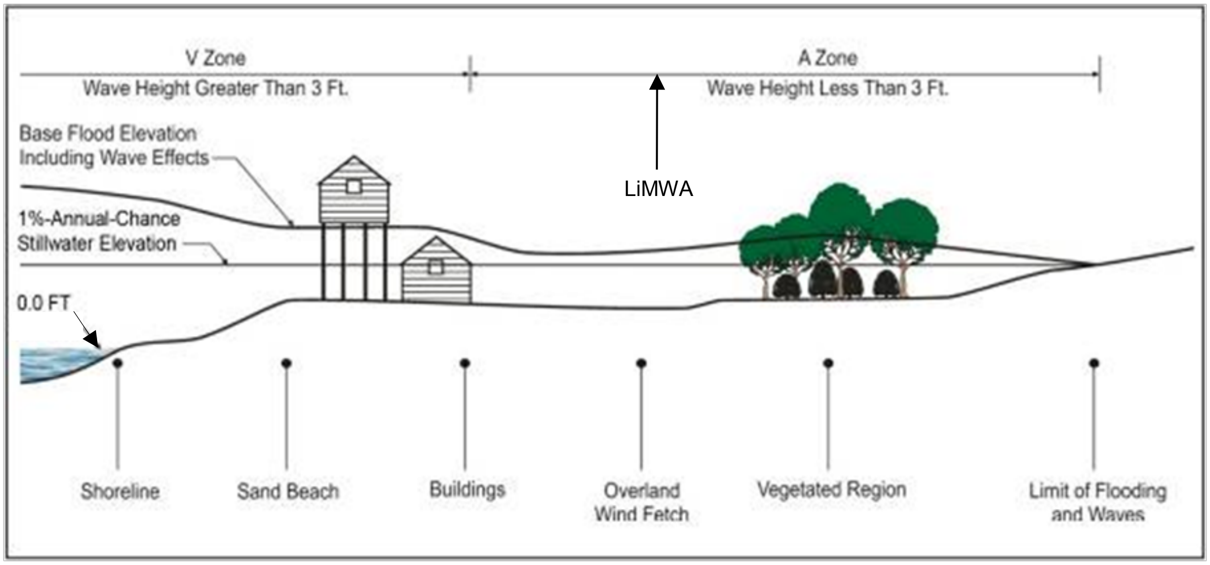
CHHAs are designated as “V” zones (for “velocity wave zones”) and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as “A” zones on the FIRM.

Figure 6, “Coastal Transect Schematic,” illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this FIS project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the Stillwater elevations shown in Table 17 due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

This section is not applicable to this FIS project.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM" In many cases, the BFE on the FIRM is higher than the Stillwater elevations shown in Table 17: Coastal Transect Parameters due to the presence of wave effects. The higher the elevation should be used for construction and/or floodplain management purposes.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in the unincorporated and incorporated areas of Snohomish County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
CITY OF ARLINGTON	AE, X
CITY OF BOTHELL	A, AE, X
CITY OF BRIER	A, AE, X
TOWN OF DARRINGTON	AE, X
CITY OF EDMONDS	A, AE, VE, X
CITY OF EVERETT	A, AE, VE, X
TOWN OF GRANITE FALLS	A, X
CITY OF GOLD BAR	AE, X
TOWN OF INDEX	AE, X
CITY OF LAKE STEVENS	A, X
CITY OF LYNNWOOD	A, AE, VE, X
CITY OF MARYSVILLE	A, AE, X
CITY OF MILL CREEK	A, X
CITY OF MONROE	A, AE, X
CITY OF MOUNTLAKE TERRACE	A, X
CITY OF MUKILTEO	AE, VE, X
CITY OF SNOHOMISH	A, AE, X
SNOHOMISH COUNTY (UNINCORPORATED AREAS)	A, AE, AH, AO, OW, VE, X
CITY OF STANWOOD	AE, X
STILLAGUAMISH TRIBE	
CITY OF SULTAN	AE, AH, X
TULALIP TRIBE	AE, AH, AO, VE, X
TOWN OF WOODWAY	AE, VE, X

3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added “Otherwise Protected Areas” (OPA) to the system. These areas are collectively referred to as the John. H Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4, “Coastal Barrier Resource System Information.”

Table 4: Coastal Barrier Resources System Information

[Not Applicable to this FIS Project]

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (sq miles)
Lake Chelan	17020009	Stehekin River	The Columbia River Basin above the confluence with the Snake River Basin	955
Wenatchee	17020011	Columbia River		1,350
Sauk	17110006	Sauk River	Drainage that discharges into the Puget Sound and the Straits of Georgia and of Juan de Fuca	741
Lower Skagit	17110007	Skagit River		447
Stillaguamish	17110008	Stillaguamish River		704
Skykomish	17110009	Skykomish River		853
Snoqualmie	17110010	Snoqualmie River		693
Snohomish	17110011	Snohomish River		278
Lake Washington	17110012	Sammish River		619
Puget Sound	17110019	Puget Sound		2,550

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Snohomish County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
Hat Slough	The presence of a high tide will restrict the drainage capacity of Hat Slough and the old channel, causing an increased backwater effect. During the 67-year period from 1910 to 1977, Stillaguamish River floodflows have exceeded the zero-damage level more than 45 times. The only river gage below the confluence of the North and South Fork Stillaguamish Rivers is the stage gage at the City of Arlington.
North Creek	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. Flooding on North Creek occurred in March 1950, when the flow reached 680 cfs. Because land use in the valley at that time was agricultural, the flooding had minimal impact. High water in December 1975 was reportedly contained within the North Creek channel. There are no gage records of this event. Localized ponding areas developed every winter because of the poorly drained soils in the valley. Since the mid-1980s, only one event has significantly inundated portions of the North Creek floodplain. On January 18, 1986, a peak flow of 914 cfs was recorded at the Snohomish County North Creek stream gage located just upstream of the limits of detailed study reach. During this event, a berm located along the county line gave way and floodwaters inundated the floodplain between the North Creek west levee and Interstate 405. No buildings existed at the time and no significant flood damage was reported.
North and South Fork Stillaguamish River	Stream gradients of the North and South Fork Stillaguamish Rivers are relatively steep with well-defined channels. The primary flood problem in bank erosion with some agricultural land inundation. However, these valleys are sparsely populated and undeveloped, and flood damage is minor.
Pilchuck Creek	Flooding by the Snohomish and Pilchuck Rivers is confined primarily to the southeastern part of the City of Snohomish where there are scattered residences and undeveloped land.
Scriber Creek	Scriber Creek is typical of many small urban streams. Its hydrologic regime has been greatly altered by extensive urban development, loss of wetland storage, and channelization of the creek. A comprehensive survey and review of flooding problems was recently carried out for development of the Scriber Creek Watershed Management Plan (Reference 1). Intermittent flooding has been reported at several locations along Scriber Creek. Problems have largely been confined to roadway flooding, with little damage to private property. Flooding occurred

Table 6: Principal Flood Problems *(continued)*

Flooding Source	Description of Flood Problems
	during the storms of January 17-18, 1986, and January 9, 1990. The estimated January 1986 peak flow had a return period of approximately 20 years. The return period for the January 1990 event has not been determined. *(continued on next page)* The principal flooding problems along Scriber Creek, as abstracted from the Scriber Creek Watershed Management Plan, are as follows: Scriber Creek at 196th Street Southwest -- Flooding occurs periodically across a low stretch of old 196th Street Southwest, which provides access to a number of small businesses. Flooding also occurs several hundred feet upstream from this point where Scriber Creek enters two 42-inch culverts. The hydraulic conditions in this reach are complicated and several factors appear to contribute to the problems. These include the limited capacity of culverts or bridges at several bridge crossings (which impose high tailwaters on upstream culverts), heavy siltation, and extremely poor hydraulic conditions in the 42-inch culverts. These have an abrupt 90-degree turn halfway down their length, where there is a change from concrete pipe to corrugated metal. Scriber Creek at 50th Avenue West and 200th Street Southwest and Edenbrook Apartments -- Flooding across 50th Avenue West and 200th Street Southwest has occurred during high-intensity storms. At this intersection, Scriber Creek crosses the roadway diagonally through two 65- by 40-inch corrugated metal culverts. Several factors contribute to local flooding, including poor entrance conditions, siltation, and downstream backwater effects. The stream channel downstream of this intersection has a very low gradient. During moderately high flows of 75 cfs or more, the outlets are submerged. Flooding problems also occur in the Edenbrook Apartments and several commercial buildings upstream from where Scriber Creek crosses 200th Street Southwest. 44th Avenue West -- Scriber Creek crosses under 44th Avenue West in two 42-inch culverts and one 66-inch culvert. Prior to mid-September 1989, flooding across 44th Avenue West occurred several times a year during moderate flows on Scriber Creek. The flooding was caused by insufficient culvert capacity due to silt and debris obstructing approximately 90 percent of the three culverts. The limited capacity of the culverts caused stormwaters to back up and temporarily store upstream of the culverts and then to spill over the roadway.
Skykomish River	The largest recorded flood on the Skykomish River occurred in December 1980, when a peak discharge of 90,100 cfs was recorded at the stream gage near the City of Gold Bar approximately 23 miles above the confluence. Stream-gaging records for this site have been maintained since 1929. During the flood of December 1975, three crests were recorded near the City of Gold Bar during a period of less than 3 days and with a maximum peak discharge of 77,000 cfs.

Table 6: Principal Flood Problems *(continued)*

Flooding Source	Description of Flood Problems
	Approximately 3,900 acres of agricultural land were inundated during the December 1975 flood along the Skykomish River, and 130 homes were damaged, mostly in the Cities of Monroe and Sultan.
Snohomish River	The three largest floods of record on the Snohomish River occurred in February 1951, November 1959, and December 1975. Although the February 1951 flood was the largest flood, with a peak of 136,000 cfs at the Snohomish gage, the November 1959 flood reached a stage approximately 0.8 foot higher, with a maximum discharge of 113,300 cfs. The highest stage at the City of Snohomish was reached during the December 1975 flood, approximately 2.9 feet higher than occurred in February 1951. Discharge records are not available for the December 1975 flood at the City of Snohomish, but the peak is estimated to be approximately 130,000 cfs. Increasing flood stages over the past 25 years on the Snohomish River are attributed to constriction of the channel and overbank flow areas by levee construction and improvement after each significant flood event, based on flood routings from upstream gaging stations. Because of the agricultural setting of the Snohomish River valley, most flood damage is to land, crops, livestock, and related improvements. During the December 1975 flood, approximately 18,500 acres of agricultural land were inundated, 237 homes damaged, and approximately 1,500 head of livestock lost
Snoqualmie River	The Snoqualmie River floodplain within Snohomish County consists almost entirely of fertile farmlands, with the City of Monroe being the only nearby major population center. However, this low valley is inundated to some extent almost every winter. Streamflows on the Snoqualmie River are recorded at the USGS stream-gaging station near the Town of Carnation in King County. This station is located approximately 24 miles from the confluence and has been in operation since 1930. Due to an extensive floodplain and lower channel slope, flood-discharge hydrographs near the Town of Carnation are characterized by somewhat slower runoff response, with less pronounced peaks and broader crests than at other major gage sites in the Snohomish River basin above the City of Monroe. Although the February 1932 flood was the highest recorded flood on the Snoqualmie River, with a peak discharge of 59,500 cfs near the Town of Carnation, the largest runoff flood occurred in December 1975, when the highest average 1- through 10-day discharges were recorded and the river reached a maximum discharge of 52,000 cfs. Other major floods occurred in November 1932, when stream lows reached a maximum discharge of 59,000 cfs, and in February 1951, when river flow reached 52,200 cfs.
Stillaguamish River	Streamflow records for the Stillaguamish River have been reported at USGS stream- gaging stations on the South Fork Stillaguamish River near the Town of Granite Falls and North Fork Stillaguamish River near the City of Arlington since 1928. Streamflow records are not available

Table 6: Principal Flood Problems *(continued)*

Flooding Source	Description of Flood Problems
	for the main stem, but river stages are reported from a National Weather Service (NWS) non-recording gage on the Stillaguamish River at the City of Arlington. All major floods of record on the Stillaguamish River have occurred between November and February and *(continued on next page)* were caused by high rates of precipitation with accompanying snowmelt. Discharges usually rise and fall rapidly, and two or more crests may occur in rapid succession as a series of storms move across the basin. The Stillaguamish River basin suffers damaging floods approximately every 3 to 5 years. The largest flood of record along the Stillaguamish River occurred in February 1932, with a maximum discharge estimated to be 65,000 cfs at the City of Arlington, 32,400 cfs on the South Fork near the Town of Granite Falls, and 27,700 cfs on the North Fork near the City of Arlington. In February 1951, floodflows reached an estimated peak of 61,000 cfs at the City of Arlington, 27,600 cfs on the South Fork near the Town of Granite Falls, and 30,600 cfs on the North Fork near the City of Arlington. Other extreme floods occurred in November 1958 and November and December 1959, with peak discharges at the City of Arlington estimated at 58,500, 59,600, and 54,800 cfs, respectively. Stream gradients of the North and South Fork Stillaguamish Rivers are relatively steep with well-defined channels. The primary flood problem is bank erosion with some agricultural land inundation. However, these valleys are sparsely populated and undeveloped, and flood damage is minor. Between the City of Arlington and the community of Silvana, low intermittent levees provide some protection to agricultural lands. Below Silvana, flood damages are aggravated by high tides that increase flood stages. A levee system protects most of this area from spring floods; however, the levees are low, with narrow cross sections, and are incapable of withstanding floodflows in excess of approximately 45,000 cfs or approximately a 3-year event. Floods caused frequent and extensive damage to pasture and croplands, bridges, highways, and utilities. In the December 1975 flood, the Stillaguamish River peaked at approximately 57,000 cfs on the Arlington gage, which is estimated at approximately an 8-year-recurrence-interval flood. A total of 7,900 acres was flooded, causing an estimated $1,474,000 in damages, the highest in 16 years in the basin. Flooding in Snohomish County resulted in the declaration of the county as a Federal disaster area on December 13, 1975. The December 1977 flood was less severe, although it also resulted in the declaration of Snohomish County as a Federal disaster area on December 10, 1977. The river peaked at approximately 46,500 cfs at the City of Arlington, which is estimated at a 3-year-recurrence-interval flood. Farmlands south of the City of Stanwood were flooded, as well as some low-lying areas in the communities of Florence and Silvana east of the City. Damage within the City of Stanwood was minor, mostly because of a successful flood fight. The following account from the December 10, 1975, *Stanwood News* describes the December 3, 1975, flood in the City of Stanwood: "Stanwood residents awoke Wednesday morning of last week to

Table 6: Principal Flood Problems *(continued)*

Flooding Source	Description of Flood Problems
	find many of their upriver neighbors already flooded by the rampaging Stillaguamish, and water pouring into town at two points. Main source of flooding in the east side of town was where Florence Road goes beneath *(continued on next page)* the railroad overpass. Floodwater lapping over the dike near the Twin City Foods' Diner ... poured into the west end of town to cause at least minor flooding in several places of business." Nearly all of the City of Arlington is situated on a bluff, and the estimated 1-percent-annual-chance flood will only inundate 5 to 10 acres near the southwestern side of the State Route 9 bridge over the Stillaguamish River and 10 to 15 acres in the extreme northeastern part of the City.
Swamp Creek	Localized flooding damages were reported along Swamp Creek for the January 1986 flood of record on Swamp Creek and were primarily related to channel-bank erosion, overtopping of roadways and resulting damages (including culvert washouts), and limited damages to residential structures.
Wallace River	The Wallace River is not a major flooding factor because areas subject to flooding from the Wallace River are more significantly affected by backwater from the Skykomish River.

Table 7 contains information about historic flood elevations in the communities within Snohomish County.

Table 7: Historic Flooding Elevations

[Not Applicable to this FIS Project]

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Snohomish County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Pilchuck River	Pilchuck Dam	Dam	Located approximately 5.4 miles from Granite Falls	Provides water diversion from the Pilchuck River to the City of Snohomish

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee's certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3 and in Table 9. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within Snohomish County. Table 9, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that FEMA has identified levees in this jurisdiction that have not been demonstrated by the community or levee owner to meet the requirements of the 44CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1-percent-annual-chance flood protection. As such, the existing flood hazard analysis in the affected areas has been carried forward from the previously-printed effective FIRM panel(s) and the area has been clearly identified on the FIRM panel with notes and bounding lines. This has been done to inform users that a temporary mapping action has been put in place until such time as FEMA is able to initiate a new flood risk project to apply new flood hazard mapping procedures for leveed areas. These levees occur on FIRM panels 53061C0351F, 53061C0352F, 53061C0355F, 53061C0715G, 53061C0716G, 53061C0717G, 53061C0720G, 53061C1030G, 53061C1035G, 53061C1040G, 53061C1045G, 53061C1061G, 53061C1062G, 53061C1065G, 53061C1125F, 53061C1150F, 53061C1343F, 53061C1407F, 53061C1430F on the Ebey Slough, Hat Slough, Lower Stillaguamish River, Marshland Diversion Channel, North Creek, Skykomish River, Snohomish

River, Steamboat Slough, and Union Slough and are identified on the FIRM panel(s) as potential areas of flood hazard data changes based on further review. Levees and their accreditation status are listed in Table 9 of this FIS report.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Snohomish County (Unincorporated Areas)	Ebey-Steamboat Slough Connector	LB	Snohomish Diking Improvement District (D.I.D.) No.1	Y	5505000079		53061C0720G	Non-Accredited
Snohomish County (Unincorporated Areas)	Ebey Slough	RB	Snohomish County Diking District No. 2	Y	5505000081		53061C0720G 53061C1035G	Non-Accredited
Snohomish County (Unincorporated Areas)	Ebey Slough	RB	Snohomish County	Y	5505000082		53061C1035G	Non-Accredited
Snohomish County (Unincorporated Areas)	Ebey Slough	LB	Snohomish D.I.D. No.1	Y	5505000079		53061C0720G 53061C1035G	Non-Accredited
City of Marysville	Ebey Slough	RB	N/A	N/A	N/A		53061C0716G	Non-Accredited
City of Marysville, Snohomish County (Unincorporated Areas), TULALIP TRIBE	Ebey Slough	LB	N/A	N/A	N/A		53061C0716G 53061C0717G 53061C0720G	Non-Accredited

Table 9: Levees *(continued)*

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
City of Marysville	Ebey Slough	RB	N/A	N/A	N/A		53061C0716G 53061C0717G	Non-Accredited
Snohomish County (Unincorporated Areas)	Hat Slough	RB	Stillaguamish Flood Control District	Y	5505000096		53061C0355F	Non-Accredited
Snohomish County (Unincorporated Areas)	Hat Slough	LB	Stillaguamish Flood Control District	Y	5505000114		53061C0355F	Non-Accredited
Snohomish County (Unincorporated Areas)	Jurgensen Slough	LB	Stillaguamish Flood Control District 1	Y	5505000310		53061C0351F 53061C0352F	Non-Accredited
Snohomish County (Unincorporated Areas)	Jurgensen Slough	RB	Stillaguamish Flood Control District 1	Y	5505000062		53061C0351F 53061C0352F	Non-Accredited
Snohomish County (Unincorporated Areas)	Lower Stillaguamish River	LB	N/A	N/A	N/A		53061C0332F 53061C0351F 53061C0352F 53061C0355F	Non-Accredited
Snohomish County (Unincorporated Areas)	Lower Stillaguamish River	RB	Stillaguamish Flood Control District	Y	5505000178		53061C0332F 53061C0351F	Non-Accredited
Snohomish County (Unincorporated Areas)	Lower Stillaguamish River	RB	Stillaguamish Flood Control District	Y	5505000178		53061C0351F 53061C0352F	Non-Accredited

Table 9: Levees *(continued)*

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Snohomish County (Unincorporated Areas)	Lower Stillaguamish River	RB	Stillaguamish Flood Control District	Y	5505000178		53061C0352F 53061C0355F	Non-Accredited
City of Everett, Snohomish County (Unincorporated Areas)	Marshland Diversion Channel	N/A	N/A	N/A	N/A		53061C1030G 53061C1035G 53061C1045G 53061C1061G 53061C1065G	Non-Accredited
Snohomish County (Unincorporated Areas)	Marshland Diversion Channel	N/A	N/A	N/A	N/A		53061C1061G 53061C1065G	Non-Accredited
Snohomish County (Unincorporated Areas)	Marshland Diversion Channel	N/A	N/A	N/A	N/A		53061C1061G 53061C1065G	Non-Accredited
City of Bothell	North Creek	LB	N/A	N/A	N/A		53061C1339F 53061C1343F	Non-Accredited
Snohomish County (Unincorporated Areas)	Pilchuck River	LB	French Slough Flood Control District	Y	5505000320		53061C1062G 53061C1065G	Non-Accredited
City of Snohomish, Snohomish County (Unincorporated Areas)	Pilchuck River	RB	N/A	N/A	N/A		53061C1062G 53061C1065G	Non-Accredited
Snohomish County (Unincorporated Areas)	Puget Sound	N/A	N/A	N/A	N/A		53061C0355F	Non-Accredited

Table 9: Levees *(continued)*

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Snohomish County (Unincorporated Areas)	Puget Sound	N/A	N/A	N/A	N/A		53061C0332F 53061C0351F 53061C0355F	Non-Accredited
Snohomish County (Unincorporated Areas)	Skykomish River	RB	Snohomish County	Y	5505000019		53061C1407F 53061C1430F	Non-accredited; seclusion
Snohomish County (Unincorporated Areas)	Skykomish River	RB	Snohomish County	Y	5505000018		53061C1427F 53061C1430F	Provisionally Accredited Levee
Snohomish County (Unincorporated Areas)	Snohomish River	RB	Snohomish D.I.D. No.1	Y	5505000079		53061C1030G 53061C1035G	Non-Accredited
City of Snohomish, Snohomish County (Unincorporated Areas)	Snohomish River	RB	N/A	N/A	N/A		53061C1061G	Non-Accredited
City of Everett, Snohomish County (Unincorporated Areas)	Snohomish River	RB	City of Everett, D.I.D. No. 5	N/A	N/A		53061C0715G 53061C0720G 53061C1035G	Non-Accredited
Snohomish County (Unincorporated Areas)	Snohomish River	RB	Snohomish D.I.D. No. 13	Y	5505000266		53061C1035G 53061C1045G	Non-Accredited

Table 9: Levees *(continued)*

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
City of Everett, Snohomish County (Unincorporated Areas)	Snohomish River	LB	Marsh Flood Control District	Y	5505000166		53061C1030G 53061C1035G 53061C1045G 53061C1061G 53061C1062G 53061C1065G	Non-Accredited
Snohomish County (Unincorporated Areas)	Snohomish River	RB	French Slough Flood Control District	Y	5505000320		53061C1065G	Non-Accredited
Snohomish County (Unincorporated Areas)	Steamboat Slough	LB	N/A	N/A	N/A		53061C0720G 53061C1035G	Non-Accredited
Snohomish County (Unincorporated Areas)	Steamboat Slough	RB	Snohomish D.I.D. No.1	Y	5505000079		53061C0720G 53061C1035G	Non-Accredited
City of Everett	Steamboat Slough	LB	N/A	N/A	N/A		53061C0715G	Non-Accredited
City of Marysville, Snohomish County (Unincorporated Areas), TULALIP TRIBE	Steamboat Slough	RB	N/A	N/A	N/A		53061C0716G 53061C0720G	Non-Accredited
City of Everett, Snohomish County (Unincorporated Areas)	Steamboat Slough	LB	N/A	N/A	N/A		53061C0715G 53061C0716G 53061C0720G	Non-Accredited

Table 9: Levees *(continued)*

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
City of Everett, Snohomish County (Unincorporated Areas)	Steamboat Slough	N/A	N/A	N/A	N/A		53061C0716G	Non-Accredited
Snohomish County (Unincorporated Areas)	Stillaguamish River	RB	Stillaguamish Flood Control District	Y	5505000178		53061C0355G 53061C0360G 53061C0380G	Non-Accredited
City of Everett, Snohomish County (Unincorporated Areas)	Union Slough	LB	Snohomish D.I.D. No. 5	Y	5505000293		53061C0715G 53061C0716G 53061C0720G 53061C1035G	Non-Accredited
Snohomish County (Unincorporated Areas)	Union Slough	RB	N/A	N/A	N/A		53061C0720G 53061C1035G	Non-Accredited
City of Everett, Snohomish County (Unincorporated Areas)	Union Slough	RB	City of Everett D.I.D. No.5	N/A	N/A		53061C0715G 53061C0716G 53061C0720G	Non-Accredited

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources 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 that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 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-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 28, "Incorporated Letters of Map Change", which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, "FIRM Revisions."

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10: Summary of Discharges.

.Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in

Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17: Coastal Transect Parameters.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Canyon Creek	At mouth	62.4	9,550	*	12,400	13,700	*	16,300
Canyon Creek	Below Mud Lake Outlet	52.5	8,500	*	11,000	12,200	*	14,500
Canyon Creek	Above Mud Lake Outlet	47.0	7,540	*	9,800	10,800	*	12,900
Canyon Creek	At RM 8	43.5	7,260	*	9,420	10,400	*	12,400
May Creek	At mouth	9.8	1,870	*	2,430	2,660	*	3,210
May Creek	At RM 3.66	7.2	1,370	*	1,820	2,010	*	2,550
North Creek	At 240th Street Southeast (Gage No. 12126100)	27.6	958	*	1,290	1,440	*	1,810
North Creek	Upstream of confluence of Palm Creek	*	940	*	1,130	1,260	*	1,580
North Creek	At 220th Street Southeast	*	750	*	1,020	1,140	*	1,420
North Creek	Upstream of 214th Street Southeast	*	710	*	960	1,060	*	1,310
North Fork Skykomish River	RM 0-4	147	25,300	*	36,700	42,000	*	54,700
North Fork Skykomish River	RM 4-8	*	—[2]	*	—[2]	42,000	*	—[2]
North Fork Stillaguamish River	At mouth	284	28,100	*	30,300[2]	31,100[1]	*	32,100[1]
North Fork Stillaguamish River	At Gage No. 1670, near City of Arlington	262	28,100	*	30,300[2]	31,100[1]	*	32,100[1]
North Fork Stillaguamish River	Below Deer Creek	239	27,300	*	31,900	33,800	*	37,300
North Fork Stillaguamish River	Above Deer Creek	172	21,400	*	24,800[2]	26,400[1]	*	28,900[1]

* Data not available

[1] Decrease in discharge due to overbank storage

[2] 1% annual chance only, limited detailed study

Table 10: Summary of Discharges *(continued)*

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
North Fork Stillaguamish River	Below Boulder River	139	20,800	*	27,900	31,000	*	37,800
North Fork Stillaguamish River	Above Boulder River	113	17,600	*	23,400	26,200	*	31,500
North Fork Stillaguamish River	Below Squire Creek	83.0	17,100	*	24,800	27,500	*	35,400
North Fork Stillaguamish River	Above Squire Creek	58.0	14,000	*	20,400	22,800	*	29,600
North Fork Stillaguamish River	At RM 34.7	49.0	13,000	*	19,300	21,500	*	28,000
Pilchuck River	At mouth	135	8,900[1]	*	12,100[1]	13,300[1]	*	17,200[1]
Pilchuck River	Below tributaries (RM 8.98)	116	9,500	*	12,500	13,700	*	17,100
Pilchuck River	At gage near City of Granite Falls	54.5	7,900	*	10,500	11,700	*	14,600
Sammamish River	At mouth	240.0	2,300	*	3,300	4,300	*	5,600
Sauk River	Near community of Sauk	714	52,500	*	81,000	94,000	*	129,000
Sauk River	At Town of Darrington	*	*	*	*	70,000	*	*
Scriber Creek	At 196th Street Southwest	1.8	139	*	171	184	*	212
Scriber Creek	At outlet from Scriber Lake	2.4	175	*	206	216	*	233
Scriber Creek	At Interstate Highway 5	3.0	168	*	190	197	*	212
Scriber Creek	Below 44th Avenue West	3.5	222	*	258	270	*	292
Skykomish River	Below Sultan River	724	97,900	*	139,200	156,900	*	197,900
Skykomish River	Below Wallace River	618	82,900	*	119,200	133,700	*	171,900
Skykomish River	At gage near City of Gold Bar	535	77,700	*	113,000	128,000	*	166,000
Skykomish River	At confluence with North and South Fork	509	64,900	*	95,500	109,800	*	142,300

* Data not available

[1] Decrease in discharge due to overbank storage

[2] 1% annual chance only, limited detailed study

Table 10: Summary of Discharges *(continued)*

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs) 10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Skykomish Rivers	At North Fork Skykomish River at mouth	147	20,900	*	34,500	39,500	*	51,500
Skykomish Rivers	At North Fork Skykomish River at RM 4.00	*	20,900	*	34,500	39,500	*	51,500
Snohomish River	At City of Snohomish	1,729	125,000	*	141,000[1]	174,000[1]	*	243,000[1]
Snohomish River	Near City of Monroe	1,537	120,700	*	174,400	196,800	*	242,900
Snohomish River	At City of Everett	*	*	*	*	170,000	*	*
Snoqualmie River	Near Snoqualmie	681	51,700	*	71,100	79,100	*	95,200
Snoqualmie River	Near Carnation	603	58,200	*	82,400	91,800	*	113,300
South Fork Skykomish River	At mouth	*	—[2]	*	—[2]	76,000	*	—[2]
South Fork Stillaguamish River	At mouth	256	33,100	*	41,600[1]	45,000[1]	*	52,700[1]
South Fork Stillaguamish River	Below Jim Creek	250	33,100	*	42,600	46,000	*	54,700
South Fork Stillaguamish River	Above Jim Creek	203	30,700	*	39,500	42,700[1]	*	50,800[1]
South Fork Stillaguamish River	At RM 26	196	30,700	*	39,500	42,700[1]	*	50,800[1]
South Fork Stillaguamish River	Below Canyon Creek	182	30,700	*	39,900	43,500	*	52,800
South Fork Stillaguamish River	Above Canyon Creek	128	25,200	*	32,800	36,000	*	43,500
South Fork Stillaguamish River	At Gage No. 1610 near City of Granite Falls	119	25,200	*	32,800	36,000	*	43,500
South Fork Stillaguamish River	At RM 41	107	25,200	*	32,800	36,000	*	43,500

* Data not available

[1] Decrease in discharge due to overbank storage

[2] 1% annual chance only, limited detailed study

Table 10: Summary of Discharges *(continued)*

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
South Fork Stillaguamish River	At RM 49	82	19,300	*	25,100	27,600	*	33,400
Stillaguamish River	At mouth	684	58,500	*	70,000	75,000	*	82,000
Stillaguamish River	At City of Arlington	539	58,500	*	70,000	75,000	*	82,000
Sultan River	At mouth	106	35,100	*	51,300	59,100	*	77,900
Sultan River	At RM 3.28	98	29,000	*	42,000	48,000	*	62,000
Swamp Creek	At Swamp Creek gage at community of Kenmore, at RM 0.5	23.1	720	*	980	1,100	*	1,400
Swamp Creek	At Snohomish-King County line, at RM 2.3	20.9	660	*	900	1,010	*	1,290
Swamp Creek	Below Scriber Creek, at RM 4.5	18.2	590	*	800	900	*	1,140
Swamp Creek	Above Scriber Creek, at RM 4.5	13.0	440	*	600	670	*	850
Swamp Creek	At County Road No. 459 (Larch Way), at RM 5.4	11.7	400	*	540	610	*	780
Swamp Creek	At Interstate Highway 5 bridge, at RM 7.7	8.4	310	*	410	460	*	580
Wallace River	At mouth	58.4	7,470	*	9,560	10,450	*	12,600
Wallace River	Below Bear Creek	55.7	9,990	*	13,200	14,600	*	18,600
Wallace River	Below May Creek	50.4	9,290	*	12,300	13,600	*	17,300
Wallace River	Below Olney Creek	40.6	7,470	*	9,890	10,900	*	13,900
Wallace River	At gage near City of Gold Bar	19.0	3,550	*	5,050	5,580	*	7,090
Wallace River	At RM 7.24	17.5	3,350	*	4,440	4,910	*	6,240
Wagleys Creek	At mouth	*	—[2]	*	—[2]	320	*	—[2]
Woods Creek	RM 0-1	*	2,390	*	3,150	3,470	*	4,290
Woods Creek	RM 1-2	*	—[2]	*	—[2]	3,470	*	—[2]

* Data not available

[1] Decrease in discharge due to overbank storage

[2] 1% annual chance only, limited detailed study

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this FIS Project]

Table 11: Summary of Non-Coastal Stillwater Elevations

[Not Applicable to this FIS Project]

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Beckler River	12131000	USGS	Near Town of Skykomish	96.5	1930 1947	1933 1970
Deer Creek	12166500	USGS	Near community of Oso	65.9	1918	1930
Issaquah Creek	12121600	USGS	Near City of Issaquah	56.6	1964	1988
Jim Creek	12164000	USGS	Near City of Arlington	46.2	1938	1969
Juanita Creek	12120500	USGS	Near City of Kirkland	6.69	1964	1968
Mercer Creek	12120000	USGS	Near City of Bellevue	12.0	1956	1990
North Creek	12125900	USGS	Below Penny Creek	14.2	1985	1986
North Creek	12126000	USGS	Near City of Bothell (196th Street Southeast)	24.6	1946	1974
North Creek	12126100	USGS	Near City of Woodinville (240th Street Southeast)	27.6	1985 1989	1986 1990
North Fork Skykomish River	12134000	USGS	At Town of Index	146.0	1911 1930 1947	1922 1938 1948
North Fork Stillaguamish River	12167000	USGS	Near City of Arlington At City of Arlington	262.0	1928 1928	1975 1976[1]
Penny Creek	12125800	USGS	Near City of Everett	5.6	1985 1989	1986 1990
Pilchuck River	12152500	USGS	Near Town of GraniteFalls	54.5	1944	1971
Raging River	12145500	N/A	Near City of Fall City	N/A	1946	1988
Skykomish River	12134500	USGS	Near City of Gold Bar	535.0	1929	1976
Snohomish River	12150800	USGS	Near City of Monroe	1,537.0	1942 1930 1964 1976	1965 1963 1975
Snoqualmie River	12149000	USGS	Near Town of Carnation	603.0	1930	1976
South Fork Skykomish River	12133000	USGS	Near Town of Index	355.0	1914	1976

[1] Gage is a U.S. Weather Bureau manually operated wire-weight gage. Records are discontinuous and only stages are reported

Table 12: Stream Gage Information used to Determine Discharges *(continued)*

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
South Fork Skykomish River	12130500	USGS	Near Town of Skykomish	135.0	1930 1947	1931 1970
South Fork Stillaguamish River	12161000	USGS	Near Town of Granite Falls Above Jim Creek	119.0	1928 1937	1976 1957
Squire Creek	12165000	USGS	Near Town of Darrington	20.0	1951	1969
Stillaguamish River	N/A	N/A	At City of Arlington	N/A	1928	1976[1]
Sultan River	12137500	USGS	Near community of Startup	74.5	1935 1912 1917 1930	1974 1927 1932
Swamp Creek	12127100	USGS	At community of Kenmore	23.1	1964	1990
Wallace River	12135000	USGS	At City of Gold Bar	19.0	1959	1976

[1] Gage is a U.S. Weather Bureau manually operated wire-weight gage. Records are discontinuous and only stages are reported

5.2 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. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. 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 Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS 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.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, "Floodway Data."

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
BOULDER RIVER	From mouth	RM 3.0	N/A	N/A	1981	A	N/A
CANYON CREEK	Approximately 1.4 miles upstream of South Fork Stillaguamish River	Approximately 2.9 miles upstream of Scott Paper Road	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
EBEY SLOUGH	Confluence with Possession Sound	Approximately 13.18 miles above confluence with Possession Sound	Gage Analysis	UNET	April 2001	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
EBEY-STEAMBOAT SLOUGH CONNECTOR	Confluence with Steamboat Slough	Approximately 0.6 miles above confluence with Steamboat Slough	Gage Analysis	UNET	April 2001	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
FRENCH CREEK	From mouth	RM 2.7	N/A	N/A	1981	A	N/A
HASKEL SLOUGH	Approximately 3.4 miles upstream of confluence with Skykomish River	Approximately 1.4 miles upstream of State Route 203 Bridge	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
HAT SLOUGH	Confluence with Port Susan	Approximately 2.65 miles above confluence with Port Susan	Gage Analysis	USACE computer program 722-K5-G311	1981	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
LOWER STILLAGUAMISH RIVER	Limit of study at 84th avenue NW	Approximately 8.30 miles above limit of study at 84th avenue	Gage Analysis	USACE computer program 722-K5-G311	1981	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
MARSHLAND DIVERSION CHANNEL	Confluence above mouth	Approximately 0.36 miles upstream of Springhetti Road	Gage Analysis	USACE computer program 722-K5-G311	1981	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
MAY CREEK	Confluence with Wallace River	Approximately 0.45 miles upstream of 423rd Avenue SE	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	May Creek was redelineated to new topographic data
NORTH CREEK	At Filbert Road	Approximately 6.0 miles upstream of Filbert Road	N/A	N/A	1981	A	N/A
NORTH CREEK	Snohomish/King County boundary	At Filbert Road	EPA HSPF	USACE HEC-2	1994	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
NORTH FORK SAUK RIVER	Confluence with Sauk River	Approximately 9.0 miles upstream of confluence of Sauk River	N/A	N/A	1981	A	For the levee area between the west overbank and east setback levee, the profiles were determined considering that the levee would remain in place. For the east overbank, the profiles and floodplain boundary were determined without considering the effects of the east setback levee. (The east setback levee did not meet FEMA's freeboard requirements.)

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
NORTH FORK SKYKOMISH RIVER	Approximately 500 feet upstream of confluence with Skykomish River	Approximately 2.7 miles upstream of Fifth Street	Gage Analysis	USACE HEC-RAS	April 2006	AE w/ floodway	N/A
NORTH FORK STILLAGUAMISH RIVER	Confluence with Stillaguamish River	Approximately 2.8 miles upstream of confluence of Squire Creek	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
PILCHUCK CREEK	Confluence with Stillaguamish River	Approximately 4.6 miles upstream of confluence of Stillaguamish River	N/A	N/A	1981	A	N/A
PILCHUCK RIVER	Approximately 1.0 mile upstream of 64th Street NE	Approximately 3.9 miles upstream of 64th Street NE	N/A	N/A	1981	A	N/A
PILCHUCK RIVER	Confluence with Snohomish River	Approximately 1.0 mile upstream of 64th Street NE	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
QUILCEDA CREEK	From mouth	Approximately 5.0 miles upstream of mouth	N/A	N/A	1981	A	N/A

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
RAPID RIVER	Approximately 0.4 mile upstream of confluence with Snoqualmie River	Approximately 6.1 miles upstream of confluence with Snoqualmie River	N/A	N/A	1981	A	N/A
RILEY SLOUGH	Approximately 0.4 mile upstream of confluence with Snoqualmie River	Approximately 6.1 miles upstream of confluence with Snoqualmie River	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
SAUK RIVER	Approximately 0.5 miles downstream of Skagit/Snohomish County boundary	Approximately 3.4 miles upstream of Sauk Prairie Road	N/A	N/A	1981	A	N/A
SAUK RIVER	Approximately 0.5 miles downstream of Skagit/Snohomish County boundary	Approximately 3.4 miles upstream of Sauk Prairie Road	Frequency-Discharge Relationships	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
SCRIBER CREEK	Approximately 0.35 miles upstream of Poplar Way	Approximately 0.2 miles upstream of 196th Street SW	EPA HSPF	USACE HEC-2 & FHA HY8	1981	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
SKYKOMISH RIVER	From mouth	Confluence with the North Fork Skykomish River	N/A	N/A	1981	A	N/A

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
SKYKOMISH RIVER	Confluence with Snoqualmie River	Approximately 2.5 miles upstream of confluence of Proctor Creek	Gage Analysis	USACE HEC-RAS	April 2006	AE w/ floodway	N/A
SNOHOMISH RIVER	Confluence with Possession Sound	Approximately 0.84 miles upstream of SR-522	Gage Analysis	UNET	April 2001	AE w/ floodway	An unsteady flow model of the system was developed. The UNET model consists of 13 separate reaches with a total of almost 270 cross sections and 12 storage areas. The most significant overbank areas are the Fryelands area, which was modeled as a storage area, and Marshland, which was modeled as a conveyance area because it ties into the Snohomish River at the upstream and downstream ends. To provide better channel definition where necessary, cross-section information was supplemented with cross-section data from the original USACE hydraulic model. For the downstream reach, the density fringe areas are based on a hydraulic analysis that takes into account density fringe criteria (15% reduction of conveyance). Changes to the previous effective were made to the Marshalnd and French Slough levees. 4,200 feet of the Lower Pilchuck River levee was added and connected to French Slough. The levee information was refined in UNET.

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
SNOQUALMIE RIVER	Confluence with Skykomish River	Snohomish/King County boundary	Gage Analysis	USACE HEC-RAS	April 2006	AE w/ floodway	The hydraulic model for the baseline floodplain included eight distinct secondary flow branches in addition to the main channel reaches. These secondary flow branches were added to improve the model's simulation of complex floodplain hydraulic ocnditions including breakout flows, topographic divides, overflow channels, and storage areas.
SOUTH COOK SLOUGH	Convergence with Stillaguamish River	Approximately 1.52 miles upstream of State Highway 530	Gage Analysis	USACE computer program 722-K5-G311	1981	AE	N/A
SOUTH FORK SKYKOMISH RIVER	Confluence with Skykomish River	Approximately 2.5 miles upstream of confluence of Skykomish River	Gage Analysis	USACE HEC-RAS	April 2006	A	The hydraulic model for the baseline floodplain included eight distinct secondary flow branches in addition to the main channel reaches. These secondary flow branches were added to improve the model's simulation of complex floodplain hydraulic ocnditions including breakout flows, topographic divides, overflow channels, and storage areas.
SOUTH FORK STILLAGUAMISH RIVER	Approximately 5.5 miles upstream of confluence of Jims Creek	Approximately 8.7 miles upstream of confluence of Jims Creek	N/A	N/A	1981	A	N/A
SOUTH FORK STILLAGUAMISH RIVER	Approximately 0.5 miles upstream confluence of Canyon Creek	Approximately 7.7 miles upstream confluence of Canyon Creek	N/A	N/A	1981	A	N/A

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
SOUTH FORK STILLAGUAMISH RIVER	Approximately 1.5 miles upstream of Mountain Loop Highway	Approximately 15.1 miles upstream of Mountain Loop Highway	N/A	N/A	1981	A	N/A
SOUTH FORK STILLAGUAMISH RIVER	Confluence with Stillaguamish River	Approximately 5.5 miles upstream of confluence of Jims Creek	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
SOUTH FORK STILLAGUAMISH RIVER	Approximately 3.1 miles downstream of Jordan Road	Approximately 0.33 miles upstream of confluence of Canyon Creek	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
SOUTH FORK STILLAGUAMISH RIVER	Approximately 5.9 miles downstream of Mountain Loop Highway	Approximately 1.5 miles upstream of Mountain Loop Highway	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
STEAMBOAT SLOUGH	Confluence with Possession Sound	Approximately 7.12 miles above confluence with Possession Sound	Gage Analysis	UNET	April 2001	AE	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
STILLAGUAMISH RIVER	Approximately 2.65 miles above confluence with Hat Slough	Confluence with North Fork Stillaguamish River and South Fork Stillaguamish River	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
STILLAGUAMISH RIVER SPLIT FLOW	Confluence with North Fork Stillaguamish River	Approximately 3.62 miles upstream of confluence of North Fork Stillaguamish River	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
SUIATTLE RIVER	Skagit/Snohomish County boundary	Approximately 20.9 miles upstream of Skagit/Snohomish County boundary	N/A	N/A	1981	A	N/A
SULTAN RIVER	Confluence with Skykomish River	Approximately 3.2 miles upstream of U.S. Highway 2	USGS regional regression equations	USACE computer program 722-K5-G311	1981	AE w/ floodway	N/A
SWAMP CREEK	Approximately 1.7 miles downstream of confluence of South Fork Sultan River	Approximately 4.4 miles downstream of confluence of South Fork Sultan River	N/A	N/A	1981	A	N/A
SWAMP CREEK	Snohomish/King County boundary	Approximately 4.0 miles upstream of Magnolia Road	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
UNION SLOUGH	Confluence above Steamboat Slough	Approximately 4.5 miles upstream of confluence of Steamboat Slough	Gage Analysis	UNET	April 2001	AE	N/A

Table 13: Summary of Hydrologic and Hydraulic Analyses *(continued)*

Flooding Source	Study Limits Downstream Limit	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
WALLACE RIVER	Confluence with Skykomish River	Approximately 0.7 miles upstream of Ley Road	Gage Analysis	USACE computer program 722-K5-G311	1981	AE w/ floodway	2010 redelineation using effective Water Surface Elevations, 2009 Aerial Photos; 2010 Digital Conversion (NGVD29 to NAVD88)
WEST FORK WOODS CREEK	Confluence with Woods Creek	Bonneville Power transmission line	N/A	N/A	1981	A	N/A
WHITE CHUCK RIVER	Confluence with Sauk River	Approximately 12.9 miles upstream of confluence of Sauk River	N/A	N/A	1981	A	N/A
WOODS CREEK	From mouth	Approximately 4.0 miles upstream of mouth	N/A	N/A	1981	A	N/A

Table 14: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Canyon Creek	0.020 – 0.067	0.040 – 0.150
Ebey Slough	0.036 – 0.070	0.036 – 0.070
Ebey Steamboat Connector	0.036 – 0.070	0.036 – 0.070
Hat Slough	0.020 – 0.067	0.040 – 0.150
Marshland	0.036 – 0.070	0.050 – 0.070
May Creek	0.020 – 0.067	0.040 – 0.150
North Creek	0.035 – 0.070	0.045 – 0.150
North Fork Skykomish River	0.028 – 0.100	0.050 – 0.100
North Fork Stillaguamish River	0.020 – 0.067	0.040 – 0.150
Pilchuck River	0.020 – 0.067	0.040 – 0.150
Sammamish River	0.035 – 0.045	0.040 – 0.150
Sauk River	0.020 – 0.067	0.040 – 0.150
Scriber Creek	0.040 – 0.060	0.040 – 0.110
Skykomish River	0.028 – 0.100	0.050 – 0.100
Snohomish River	0.035 – 0.045	0.050 – 0.070
Snoqualmie River	0.020 – 0.067	0.040 – 0.150
South Fork Stillaguamish River	0.020 – 0.067	0.040 – 0.150
South Fork Skykomish River	0.038 – 0.048	0.080 – 0.120
South-Cook Slough	0.020 – 0.067	0.040 – 0.150
Steamboat Slough	0.036 – 0.070	0.036 – 0.070
Stillaguamish River	0.020 – 0.067	0.040 – 0.150
Sultan River	0.030 – 0.071	0.044 – 0.070
Swamp Creek	0.030 – 0.086	0.068 – 0.099
Wallace River	0.020 – 0.067	0.040 – 0.150

5.3 Coastal Analyses

For the areas of Snohomish County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to extreme tides and storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation. Table 15 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

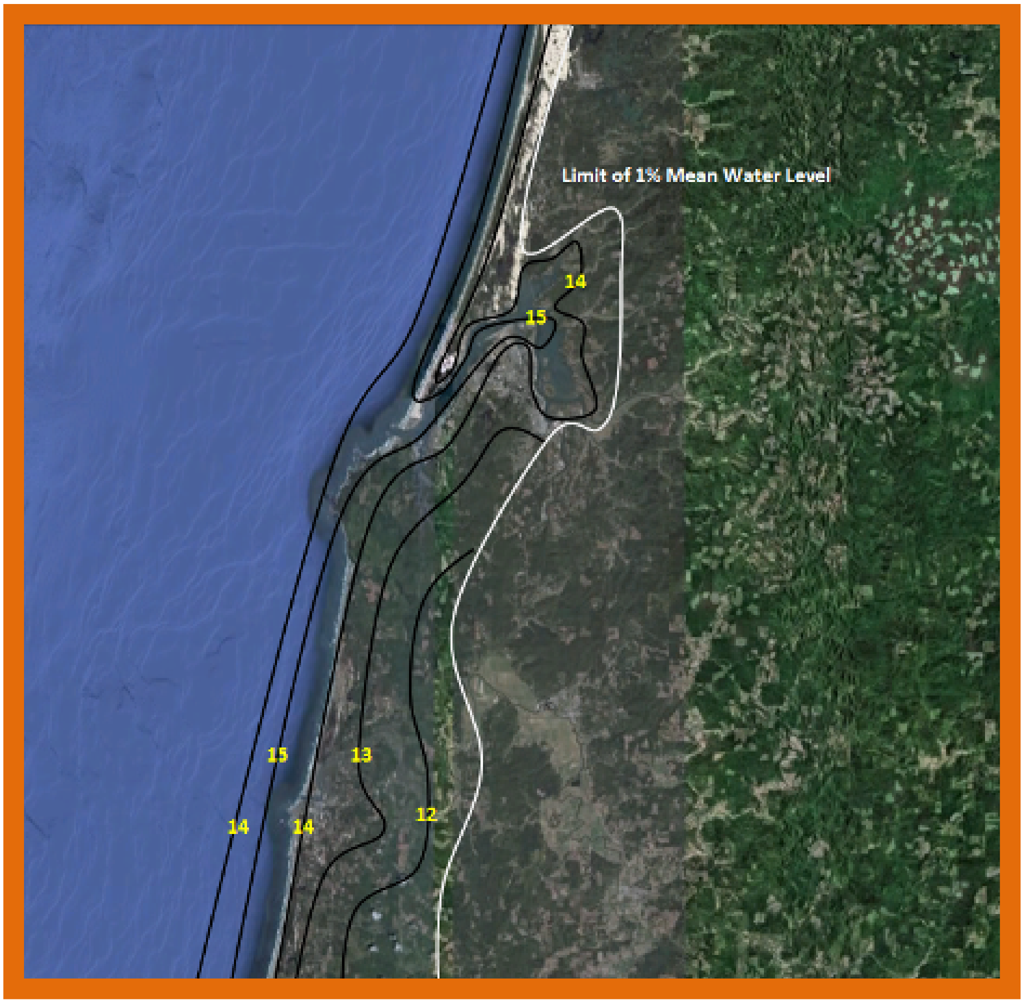
Table 15: Summary of Coastal Analyses

Flooding Source	Study Limits From	To	Hazard Evaluated	Model or Method Used	Date Analysis was Completed
Port Gardner	From approximately 2,600 feet southwest of the intersection of Thatcher Road and Spruance Boulevard	To approximately 800 feet southwest of the end of Terminal Avenue	Wave Runup	TAW/DIM	9/5/2013
Port Susan	From just south of State Highway 532	To approximately 800 feet south of the intersection of 66th Avenue NW and Tulalip Shores Road	Wave Runup	TAW/DIM	9/5/2013
Possession Sound	From approximately 800 feet south of the intersection of 66th Avenue NW and Tulalip Shores Road	To approximately 1,400 feet southwest of the intersection of Marine View Drive and Pictorial Avenue	Wave Runup	TAW/DIM	9/5/2013
Puget Sound	From approximately 1,400 feet southwest of the intersection of Marine View Drive and Pictorial Avenue	To the southern boundary of Snohomish County	Wave Runup	TAW/DIM	9/5/2013
Skagit Bay	From the northern boundary of Snohomish County	To just north of State Highway 532	Wave Runup	TAW/DIM	9/5/2013

5.3.1 Total Stillwater Elevations

The total stillwater elevations (Stillwater including storm surge plus wave setup) for the 1% annual chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 15. The Stillwater elevation that was used for each transect in coast analyses is shown in Table 17: Coastal Transect Parameters. Figure 8 shows the total Stillwater elevation for the 1% annual chance flood that was determined for this coastal analysis.

Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas



Astronomical Tide

Astronomical tidal statistics were generated directly from local tidal constituents by sampling the predicted tide at random times throughout the tidal epoch.

Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of tidal gages.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Observed tides, wind, and pressure fields were identified for 150 historic storms occurring between 1959 and 2010. Water levels resulting from tides and wind- and pressure-induced storm surge (stillwater elevations) were modeled using

ADCIRC for the entire duration of each of these 150 storms. An extreme value analysis was performed on these stillwater modeling results to determine a stillwater elevation for the 1% annual chance event.

Tidal gages can be used instead of historic records of storms when the available tidal gage record for the area represents both the astronomical tide component and the storm surge component. Table 16 provides the gage name, managing agency, gage type, gage identifier, start date, end date, and statistical methodology applied to each gage used to determine the stillwater elevations. Rather than computing return periods of stillwater at these isolated locations and approximating stillwaters spatially by interpolation, the aforementioned ADCIRC model expanded across the entirety of Snohomish County's shoreline and the broader Puget Sound region in general. All tide gages presented in Table 16 were used to calibrate the ADCIRC model to ensure that the model was producing accurate hindcasts of stillwater elevation during the historic storms.

Table 16: Tide Gage Analysis Specifics

[Not Applicable to this FIS Project]

Combined Riverine and Tidal Effects

Tidal effects based on Total Stillwater Elevations were carried upstream into areas previously determined by riverine analysis. The limits of coastal effect were set at the location where elevations from the riverine analysis were equal to the total stillwater values from the coastal analysis. A combined joint probability analysis was not performed for the tie-in areas of coastal and riverine.

Wave Setup Analysis

Wave setup was computed following the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the dynamic water level elevations. The oscillating component of wave setup, *dynamic wave setup*, as well as the static wave setup were computed and summed with the stillwater elevations to yield dynamic water levels. These water levels were computed concurrently with wave runup along each modeling transect to yield total water level prediction which incorporates all stillwater and setup components as well as wave runup.

5.3.2 Waves

An unstructured SWAN wave model grid was created covering the southern portion of the Puget Sound and the entirety of Snohomish County's coastal waters. All of the 150 historic storm events corresponding to the same time period as the events selected for stillwater level analysis were simulated using the SWAN wave model. The primary inputs at each time step were: water level, wind speed and wind direction. Model outputs (significant wave height, spectral wave period, mean wave direction) were saved at points along each transect. The wave model outputs, paired with the concurrent stillwater levels, were applied to each transect to compute dynamic and total water levels for the duration of each of the 150 historic storm events.

5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated to determine the modification to existing topography that is expected to be associated with flooding events. Erosion was evaluated using the methods listed in Table 15. This is not applicable to this study.

5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects along all shorelines for which waves were expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1% annual chance flood.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 8, "Transect Location Map," are also depicted on the FIRM. Table 17 provides the location, stillwater elevations, and starting wave conditions for each transect evaluated for overland wave hazards. In this table, "starting" indicates the parameter value at the beginning of the transect. This analyses were not applied to this study.

Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6 for a schematic of a coastal transect evaluated for overland wave propagation hazards.

Wave heights and wave crest elevations were modeled using the methods and models listed in Table 15, "Summary of Coastal Analyses".

Wave Runup Analysis

Wave runup analyses were performed to determine the height and extent of runup beyond the limit of stillwater inundation for the 1% annual chance flood. Wave runup elevations were modeled using the methods and models listed in Table 15.

Table 17: Coastal Transect Parameters

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Skagit Bay	1	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Port Susan	2	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Port Susan	3	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Port Susan	4	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Port Susan	5	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Port Susan	6	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	7	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *

*Not calculated for this FIS project

Table 17: Coastal Transect Parameters (continued)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Possession Sound	8	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Possession Sound	9	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Possession Sound	10	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Possession Sound	11	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	12	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Possession Sound	13	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	14	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *

*Not calculated for this FIS project

Table 17: Coastal Transect Parameters (continued)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Possession Sound	15	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	16	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	17	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	18	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Port Gardner	19	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	20	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Port Gardner	21	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	22	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *

*Not calculated for this FIS project

Table 17: Coastal Transect Parameters (continued)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Possession Sound	23	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	24	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	25	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	26	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	27	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Possession Sound	28	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Puget Sound	29	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Puget Sound	30	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *

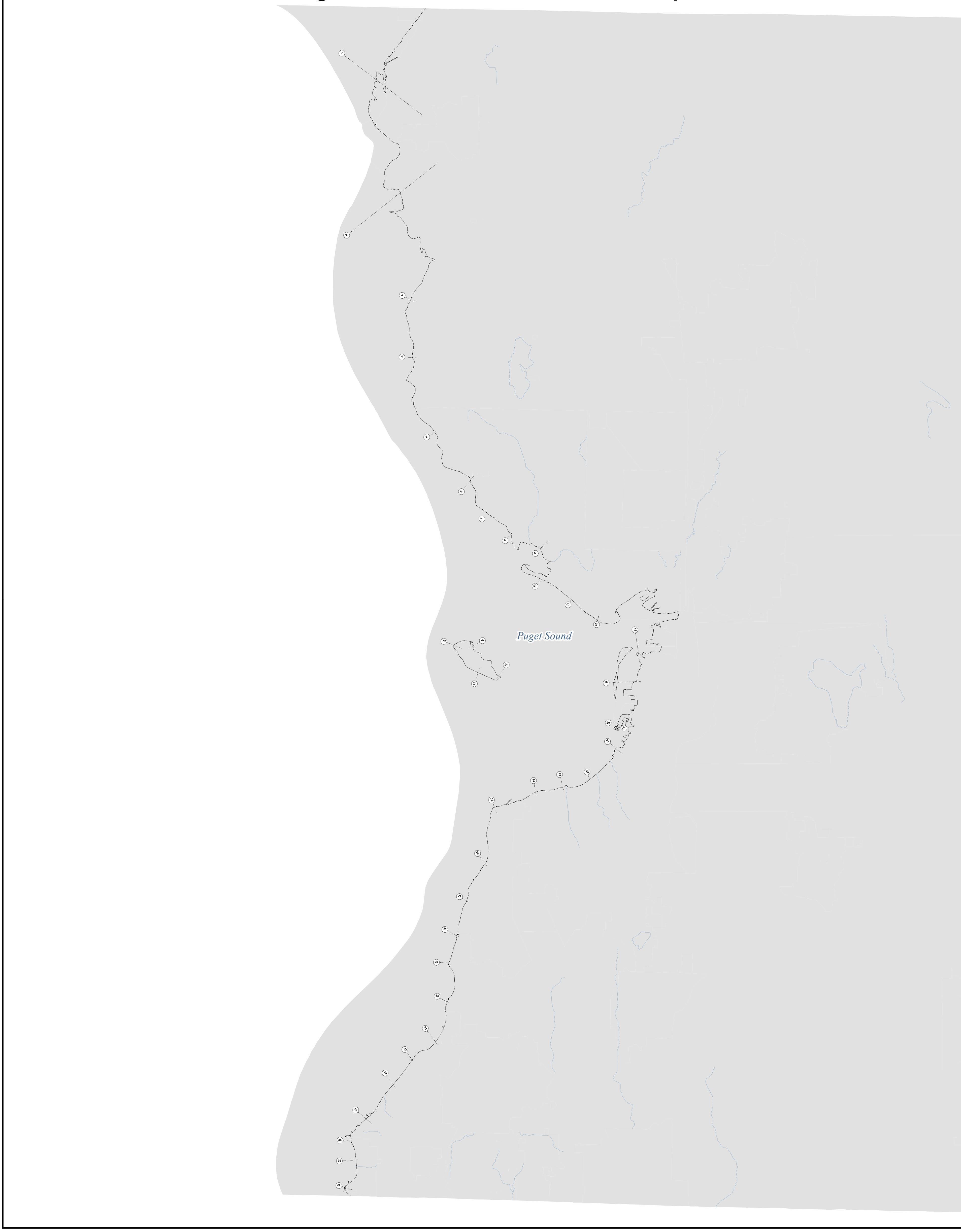
*Not calculated for this FIS project

Table 17: Coastal Transect Parameters (continued)

Flood Source	Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
		Significant Wave Height H_s (feet)	Peak Wave Period T_p (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Puget Sound	31	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Puget Sound	32	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Puget Sound	33	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Puget Sound	34	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *
Puget Sound	35	0.0	0.0	* *	* *	* *	12.6 12.6-12.6	* *
Puget Sound	36	0.0	0.0	* *	* *	* *	12.5 12.5-12.5	* *
Puget Sound	37	0.0	0.0	* *	* *	* *	12.4 12.4-12.4	* *

*Not calculated for this FIS project

Figure 9 - Transect Location Map



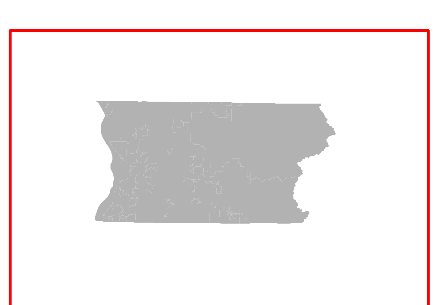
N

1 inch = 15,417 feet

0 0.5 1 2 3 4 Miles

Map Projection:
State Plane Washington North FIPS 4601 Feet
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map

PANELS PRINTED:

0020F
0040F
0335F
0351F
0355F
0365F
0695F
0700F
0715G
1010F
1015F
1020F
1030G
1285F
1292F
1294F
1305F

FEMA

5.4 Alluvial Fan Analyses

This section is not applicable to this FIS project.

Table 18: Summary of Alluvial Fan Analyses
[Not Applicable to this FIS Project]

Table 19: Results of Alluvial Fan Analyses
[Not Applicable to this FIS Project]

SECTION 6.0 – MAPPING METHODS

6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

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 and Density Fringe 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.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services NOAA,
N/NGS12National Geodetic SurveySSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please contact information services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Snohomish County are provided in Table 21.

Table 21.

Table 20: Countywide Vertical Datum Conversion

[Not Applicable to this FIS Project]

A countywide conversion factor could not be generated for Snohomish County because the maximum variance from average exceeds 0.25 feet. Calculations for the vertical offsets on a stream by stream basis are depicted in Table 21.

Table 21: Stream-by-Stream Vertical Datum Conversion

Flooding Source	Average Vertical Datum Conversion Factor (feet)
Canyon Creek	+3.8
Ebey Slough	+3.7
Ebey-Steamboat Slough Connector	+3.7
Hat Slough	+3.7
Marshland	+3.7
May Creek	+3.8
North Creek	+3.7
North Fork Skykomish River	+3.9
North Fork Stillaguamish River	+3.8
Pilchuck River	+3.7
Sauk River	+3.8
Scriber Creek	+3.6
Skykomish River	+3.7
Snohomish River	+3.7
Snoqualmie River	+3.6
South-Cook Slough	+3.7
South Fork Stillaguamish River	+3.8
Steamboat Slough	+3.7
Stillaguamish River/Lower Stillaguamish River	+3.7
Sultan River	+3.7
Swamp Creek	+3.6
Union Slough	+3.7
Wallace River	+3.7

6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM

Database and its contents can be found in FEMA's *Guidelines and Standards for Mapping Partners*, Appendix L.

Base map information shown on the FIRM was derived from the sources described in Table 22.

Table 22: Base Map Sources

Data Type	Data Provider	Data Date	Data Scale	Data Description
Airport Runways	WA Department of Transportation (WADoT)	2009	1:24,000	Airport locations
Horizontal and vertical geodetic control data for the U.S.	NOAA	2006	1:24,000	Benchmarks
Snohomish City Boundary	Snohomish County	2011	1:24,000	City boundary
Snohomish County Boundary	WA Depatment of Ecology	1999	1:24,000	County boundary
Snohomish County orthoimagery mosaic	University of Washington	2012	1:24,000	Basemap, orthophoto
Snohomish public land survey	Snohomish County	2005	1:24,000	PLSS data were developed from USGS quadrangles
Snohomish railroad centerlines	WADoT	2011	1:24,000	Railroads
Snohomish road centerlines	U.S. Census Bureau	2010	1:24,000	Roads
Snohomish water area	WA Department of Natural Resources (WADNR)	2006	1:24,000	Waterbody and ocean boundaries
Snohomish water lines	WADNR	2006	1:24,000	Streamlines

6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 23. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 23, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 23.

In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

The floodway widths presented in this FIS Report and on the FIRM 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. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 24, "Floodway Data."

Table 23: Summary of Topographic Elevation Data used in Mapping

		Source for Topographic Elevation Data			
Community	Flooding Source	Description	Scale	Contour Interval	Citation
CITY OF EDMONDS, CITY OF EVERETT, CITY OF KALE STEVENS, CITY OF LYNNWOOD, CITY OF MARYSVILLE, CITY OF MUKILTEO, CITY OF STANWOOD, CNOHOMISH COUNTY (UNINCORPORATED AREAS), TULALIP TRIBE, TOWN OF WOODWAY	All Streams (from 1981 studies)	DEM	1:1,200 1:2,400 1:4,800 1:12,000 1:24,000	2 ft 5 ft 10 ft 20 ft 40 ft 80 ft	TOPO1-9

Table 23: Summary of Topographic Elevation Data used in Mapping (continued)

Community	Flooding Source	Source for Topographic Elevation Data			
		Description	Scale	Contour Interval	Citation
CITY OF EDMONDS, CITY OF EVERETT, CITY OF KALE STEVENS, CITY OF LYNNWOOD, CITY OF MARYSVILLE, CITY OF MUKILTEO, CITY OF STANWOOD, CNOHOMISH COUNTY (UNINCORPORATED AREAS), TULALIP TRIBE, TOWN OF WOODWAY	EBEY SLOUGH, EBEY-STEAMBOAT SLOUGH CONNECTOR, HAT SLOUGH, LOWER STILLAGUAMISH RIVER, SNOHOMISH RIVER, STEAMBOAT SLOUGH, STILLAGUAMISH RIVER, UNION SLOUGH	PSLC	1:6,000	2 ft	BAKER
SNOHOMISH COUNTY (UNINCORPORATED AREAS), TULALIP TRIBE	LOWER PUGET SOUND	PSLC	1:6,000	4 ft	PSLC

BFEs shown at cross sections on the FIRM represent the 1% annual chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.