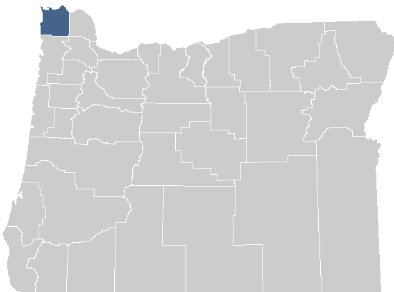
FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 2



CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
CITY OF ASTORIA	**410028**
CITY OF CANNON BEACH	**410029**
CLATSOP COUNTY UNINCORPORATED AREAS	**410027**
CITY OF GEARHART	**410030**
CITY OF SEASIDE	**410032**
CITY OF WARRENTON	**410033**

Notice

This preliminary FIS report includes only revised Flood Profiles and Floodway Data tables.

FEMA

PRELIMINARY:

May 16, 2016

FLOOD INSURANCE STUDY NUMBER
41007CV001B

Version Number 2.2.2.1

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Beerman Creek	02-04 P
Big Creek	05-06 P
Cow Creek	07-08 P
Fishhawk Creek at Birkenfeld	09-10 P
Fishhawk Creek at Jewell	11-12 P
Humbug Creek	13-15 P
Lewis and Clark River	16-26 P
Little Creek	27-28 P
Little Wallooskee River	29 P
Neacoxie Creek	30-32 P
Neawanna Creek (Lower)	33-34 P
Neawanna Creek (Upper)	35 P
Necanicum River	36-52 P
Necanicum River Overflow	53 P
Nehalem River	54-62 P
North Fork Nehalem River	63 P
North Fork Nehalem River at Hamlet	64-66 P
Northrup Creek	67-68 P
Plympton Creek	69 P

Published Separately

Flood Insurance Rate Map (FIRM)

FLOOD INSURANCE STUDY REPORT
CLATSOP COUNTY, OREGON

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 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 Clatsop County, Oregon.

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 Astoria	410028	17080006	41007C0228E, 41007C0229E, 41007C0233E, 41007C0234E, 41007C0236E, 41007C0237E, 41007C0241E, 41007C0242E, 41007C0255E, 41007C0265E	N/A
City of Cannon Beach	410029	17100201	41007C0512F, 41007C0514F, 41007C0515F, 41007C0652F	N/A

Table 1: Listing of NFIP Jurisdictions, con't

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Clatsop County, Unincorporated Areas *Panel Not Printed- Open Water Area ** Panel Not Printed- No Special Flood Hazard Areas	410027	17080006, 17100201	41007C0025E*, 41007C0050E*, 41007C0075E*, 41007C0100E*, 41007C0125E*, 41007C0150E*, 41007C0200F, 41007C0204E, 41007C0205F, 41007C0208E, 41007C0209E, 41007C0210E*, 41007C0212E, 41007C0214F, 41007C0215F, 41007C0217E, 41007C0218F, 41007C0219E, 41007C0228E, 41007C0229E, 41007C0230E*, 41007C0233E, 41007C0234E, 41007C0235E*, 41007C0236E, 41007C0237E, 41007C0240E, 41007C0241E, 41007C0242E, 41007C0245E, 41007C0260E**, 41007C0265E, 41007C0270E, 41007C0280E, 41007C0285E, 41007C0290E, 41007C0295E, 41007C0305E, 41007C0310E, 41007C0320E, 41007C0340E, 41007C0350E**, 41007C0352F, 41007C0355F, 41007C0356E, 41007C0358F, 41007C0360E, 41007C0365E* 41007C0366F, 41007C0367F, 41007C0368F, 41007C0369F, 41007C0380E, 41007C0385E, 41007C0390E, 41007C0395E**, 41007C0405E, 41007C0425E**, 41007C0450E**, 41007C0470E, 41007C0475E**,41007C0490E, 41007C0500E**, 41007C0502F, 41007C0505F, 41007C0506F, 41007C0508E, 41007C0510E, 41007C0512F, 41007C0514F, 41007C0515F, 41007C0520E, 41007C0540E, 41007C0545E, 41007C0550E**, 41007C0575E**, 41007C0590E**, 41007C0595E, 41007C0600E**,41007C0605E, 41007C0610E, 41007C0615E, 41007C0620E**, 41007C0630E, 41007C0650E**, 41007C0652F, 41007C0654F, 41007C0655E*, 41007C0662F, 41007C0665F, 41007C0675E**, 41007C0690E**, 41007C0700E**, 41007C0705E, 41007C0710E, 41007C0715E**, 41007C0720E**, 41007C0730E, 41007C0735E, 41007C0750E**, 41007C0775E**, 41007C0800E**	N/A

Table 1: Listing of NFIP Jurisdictions, con't

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
City of Gearhart	410030	17100201	41007C0366F, 41007C0367F, 41007C0368F, 41007C0369F	N/A
City of Seaside	410032	17100201	41007C0368F, 41007C0369F, 41007C0502F, 41007C0506F, 41007C0508E, 41007C0510E	N/A
City of Warrenton	410033	17080006, 17100201	41007C0204E, 41007C0208E, 41007C0209E, 41007C0212E, 41007C0214F, 41007C0215F, 41007C0216E, 41007C0217E, 41007C0218F, 41007C0219E, 41007C0236E, 41007C0240E	N/A

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 31, "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 Clatsop County became effective on September 17, 2010. Refer to Table 28 for information about subsequent revisions to the FIRM.

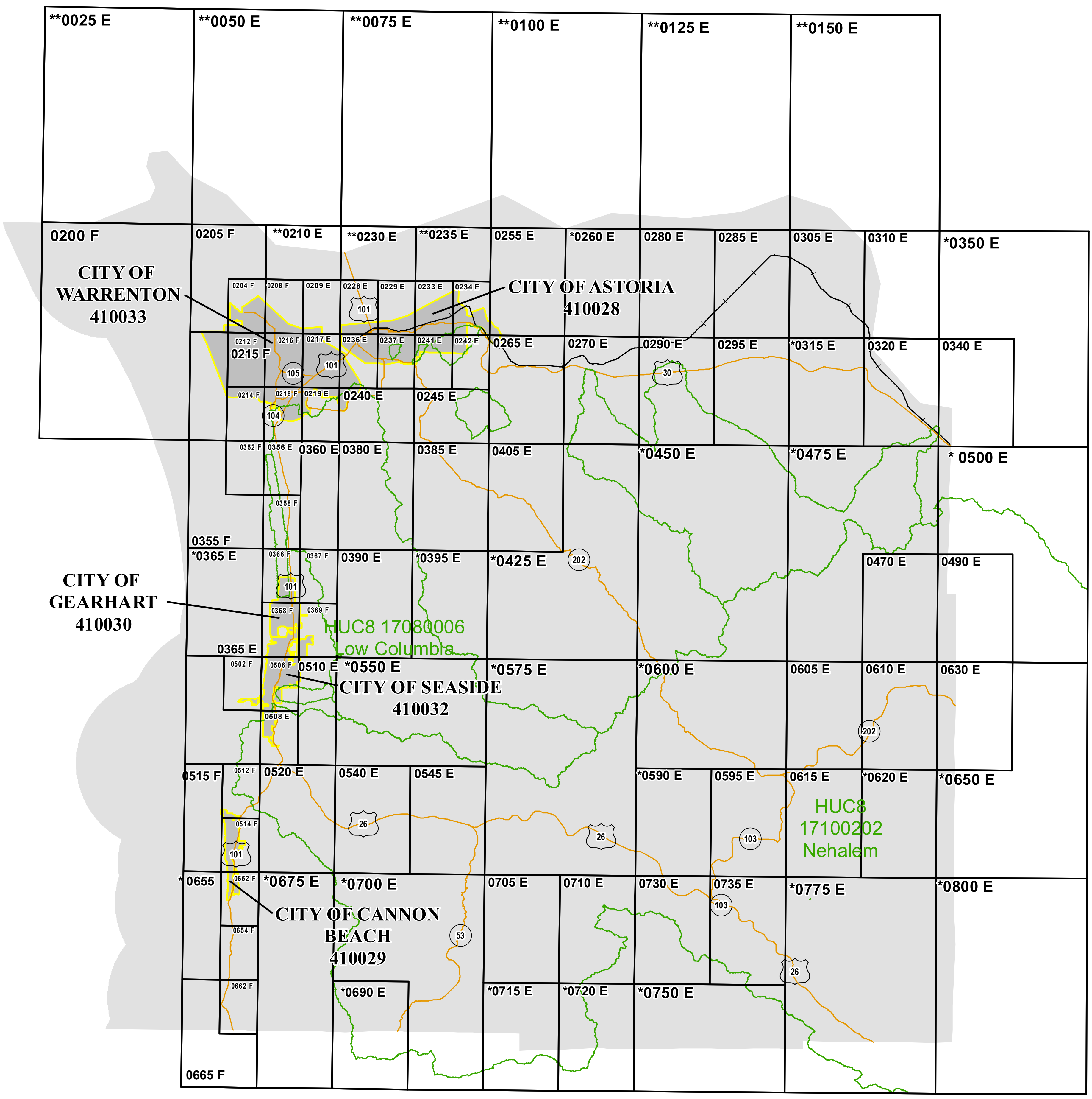
- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by 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 levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled "Mapping of Areas Protected by Levee Systems."

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees 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.

- 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.



1 inch = 5 miles

N

0 2 4 8 Miles

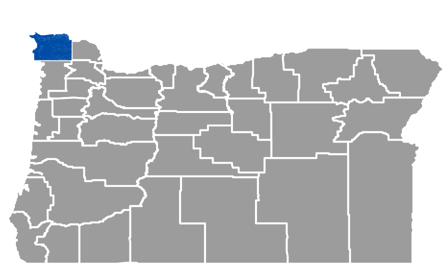
Map Projection:
NAD 1983 UTM Zone 10N
North American Datum of 1983

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 - NO SPECIAL FLOOD HAZARD AREAS
** PANEL NOT PRINTED - OPEN WATER AREA



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

CLATSOP COUNTY, OR AND INCORPORATED AREAS

PANELS PRINTED:

0200, 0204, 0205, 0208, 0209, 0212, 0214, 0215, 0216, 0217, 0218, 0219, 0228, 0229, 0233, 0234, 0236, 0237, 0240, 0241, 0242, 0245, 0255, 0265, 0270, 0280, 0285, 0290, 0295, 0305, 0310, 0320, 0340, 0352, 0355, 0356, 0358, 0360, 0366, 0367, 0368, 0369, 0380, 0385, 0390, 0405, 0470, 0490, 0502, 0505, 0506, 0508, 0510, 0512, 0514, 0515, 0520, 0540, 0545, 0590, 0595, 0605, 0610, 0615, 0630, 0652, 0654, 0662, 0665, 0690, 0705, 0710, 0730, 0735

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

PRELIMINARY
5/16/2016

MAP NUMBER
41007CIND0B

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 28 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 and 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 (NAVD 88). 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.

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.

Figure 2: FIRM Notes to Users, con't

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 10N. The horizontal datum was NAD83, GRS1980 spheroid. 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 the North American Vertical Datum of 1988. 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 the 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 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was provided by the Oregon Department of Geology and Mineral Industries (DOGAMI). Data sources include DOGAMI, Oregon Lidar Consortium, U.S. Department of Agriculture, Oregon Department of Land Conservation and Development, Clatsop County, U.S. Army Corps of Engineers, U.S. Geological Survey, Oregon Department of Administrative Services, and the National Oceanic and Atmospheric Administration. Base map information was rectified to 3-foot resolution LiDAR topographic data acquired in 2007, 2009, and 2010. For information about base maps, refer to Section 6.2 "Base Map" in this FIS Report.

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.

Figure 2: FIRM Notes to Users, con't

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Clatsop County, Oregon, 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 28 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.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Clatsop County, Oregon, effective [date to be determined].

LIMIT OF MODERATE WAVE ACTION: Zone AE has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between Zone VE and the LiMWA (or between the shoreline and the LiMWA for areas where Zone VE is not identified) will be similar to, but less severe than, those in Zone VE.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: Check with your local community to obtain more 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 or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by March 14, 2016. 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.

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, con't

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.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood. 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 flood hazard
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

Figure 3: Map Legend for FIRM, con't

	Levee, Dike, or Floodwall accredited or provisionally accredited to reduce the flood risk from the 1% annual chance flood.
	Levee, Dike or Floodwall not accredited to reduce the flood risk from the 1% annual chance flood.
Bridge	Bridge
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)

Figure 3: Map Legend for FIRM, con't

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
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 Clatsop 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 Clatsop County, Oregon, 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.

2.2 Floodways

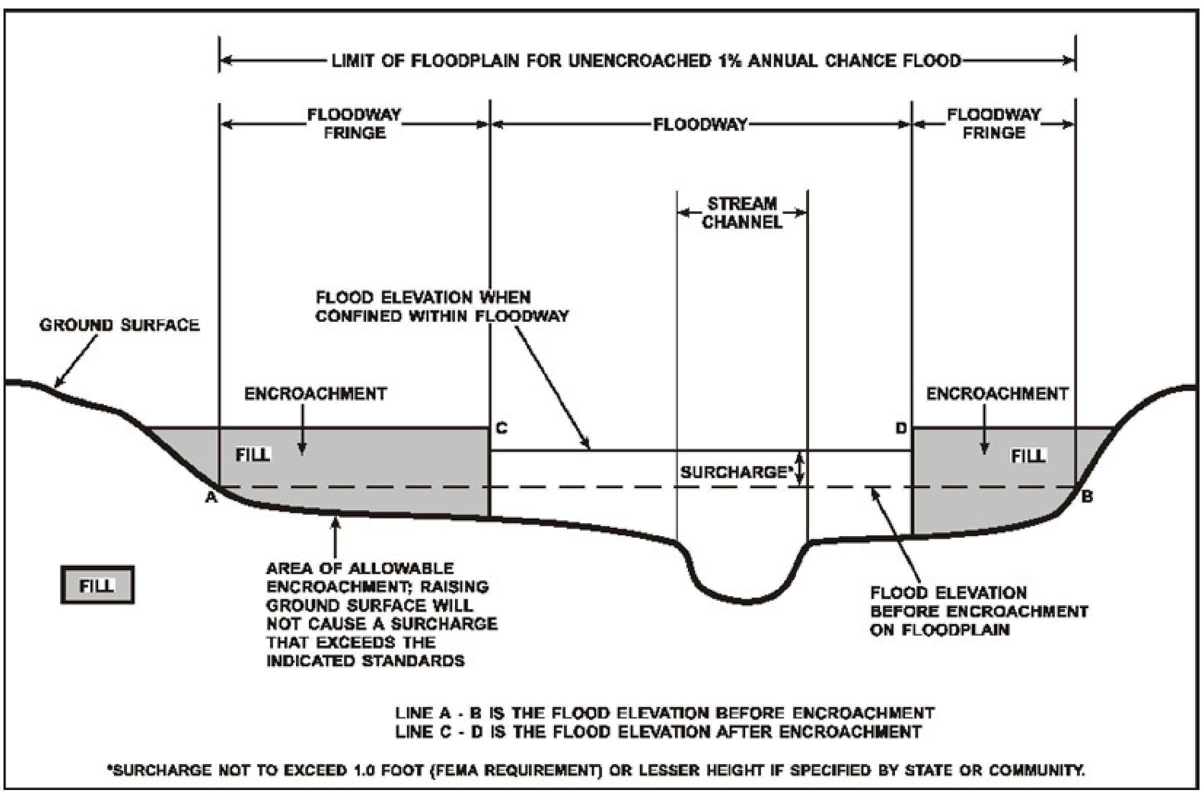
Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself.

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.

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
Bear Creek	Clatsop County	Confluence with the Columbia River	1105 feet upstream of Old Highway 30	17080006	1.13		Y	AE	May 1977
Beerman Creek	City of Seaside, Clatsop County	Confluence with the Necanicum River	2600 feet downstream of Necanicum Mainline Road	17100201	1.29		Y	AE	June 2007
Big Creek	Clatsop County	2400 feet downstream of Old Highway 30	1300 feet upstream of Highway 30	17080006	1.03		Y	AE	May 1977
Cow Creek	Clatsop County	Confluence with Nehalem River	1900 feet downstream of Hidden Spring Dr.	17100202	1.22		Y	AE	May 1977
Fishhawk Creek at Birkenfeld	Clatsop County	550 feet downstream of Sjoli Lane	1430 feet downstream of North Shore Drive	17100202	1.42		Y	AE	May 1977
Fishhawk Creek at Jewell	Clatsop County	Confluence with Nehalem River	2180 feet upstream of Highway 103	17100202	1.03		Y	AE	May 1977
Humbug Creek	Clatsop County	Confluence with Nehalem River	3360 feet downstream of Kampy Lane	17100202	2.58		Y	AE	May 1977
Lewis and Clark River	Clatsop County	965 feet downstream of Walford Johnson Creek	1965 feet upstream of Shweeash Creek	17080006	6.65		Y	AE	May 1977

Table 2: Flooding Sources Included in this FIS Report, con't

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
Little Creek	Clatsop County	1415 feet downstream of Old Highway 30	1020 feet upstream of US Highway 30	17080006	0.91		Y	AE	May 1977
Little Wallooskee River	Clatsop County	1080 feet downstream of Little Walluski Lane	2700 feet upstream of Little Walluski Lane	17080006	0.71		Y	AE	May 1977*
Neacoxie Creek	City of Gearhart, Clatsop County	730 feet downstream of G Street	930 feet upstream of Surf Pines Lane	17100201	3.07		N	AE	January 1995
Neawanna Creek (Lower)	City of Seaside, Clatsop County	730 feet downstream of 12th Avenue	At U.S. Highway 101	17100201	2.36		Y	AE	June 2007
Neawanna Creek (Upper)	City of Seaside, Clatsop County	Confluence with Neawanna Creek (Lower)	880 feet upstream of Wahanna Road	17100201	0.32		Y	AE	June 2007
Necanicum River	City of Seaside, Clatsop County	575 feet downstream of 12th Ave	6500 feet upstream of U.S. Highway 101	17100201	7.0		Y	AE	June 2007
Necanicum River	Clatsop County	6500 feet upstream of U.S. Highway 101	2920 feet downstream the confluence with Little Humbug Creek	17100201	8.2		Y	AE	May 1977
Necanicum River Overflow	City of Seaside, Clatsop County	710 feet downstream of Rippett Lane	2475 feet downstream of U.S. Highway 101	17100201	0.95		Y	AE	June 2007
Nehalem River	Clatsop County	4250 feet upstream of Fema Road	2975 feet upstream of Grub Creek	17100202	29.34		Y	AE	May 1977

Table 2: Flooding Sources Included in this FIS Report, con't

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 Fork Nehalem River	Clatsop County	740 feet upstream of Boykin Creek	1185 feet upstream of Bridge Lane	17100202	1.19		Y	AE	May 1977
North Fork Nehalem River at Hamlet	Clatsop County	2045 feet upstream of Hamlet Road	205 feet downstream of Layton Road	17100202	2.15		Y	AE	May 1977
Northrup Creek	Clatsop County	Confluence with Nehalem River	3475 feet of Northrup Creek Road crossing of Unnamed Tributary	17100202	1.77		Y	AE	May 1977
Pacific Ocean	City of Astoria, City of Cannon Beach, City of Gearhart, City of Seaside, City of Warrenton, Clatsop County	Entire Clatsop County coastline	Entire Clatsop County coastline	N/A	35.6		N	VE, V, AE	June 2014
Plympton Creek	Clatsop County	Confluence with Westport Slough	570 feet upstream of US Highway 30	17080003	0.54		Y	AE	May 1977

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 1% 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

This section is not applicable to this FIS project.

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.

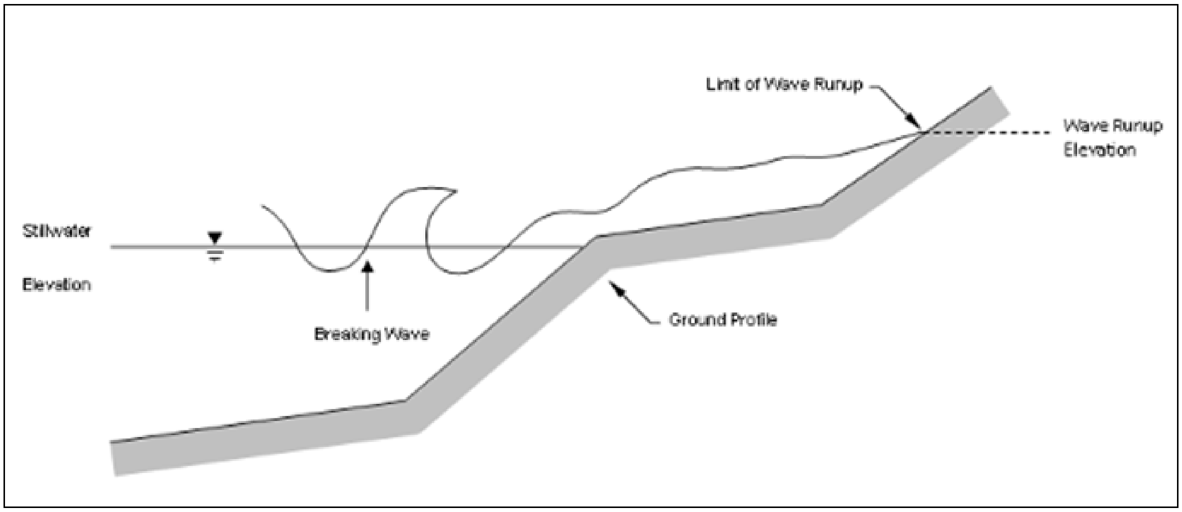
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

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 8, “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 26 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." 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 specific mapping methods is provided 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.

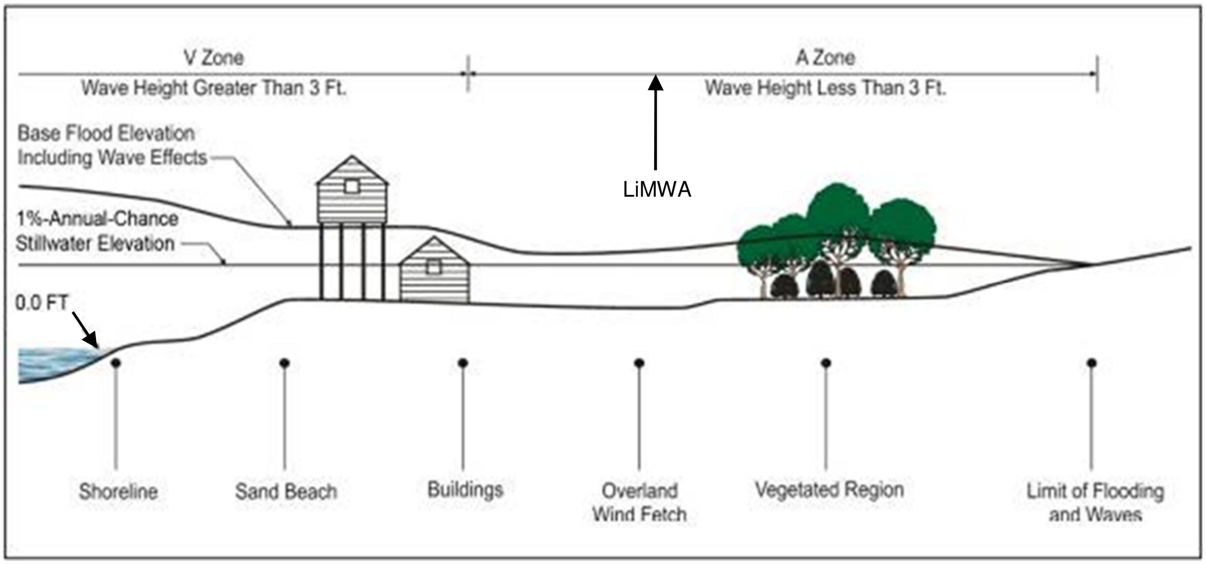
CHHAs are designated as "V" zones (for "velocity wave zones") and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the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

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 Clatsop County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Clatsop County Unincorporated Areas	A, AE, AH, D, V, VE, X
City of Astoria	A, AE, X
City of Cannon Beach	AE, V, VE, X
City of Gearhart	A, AE, VE, X
City of Seaside	AE, V, VE, X
City of Warrenton	A, AE, D, VE, X

3.2 Coastal Barrier Resources System

This section is not applicable to this FIS project.

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 (square miles)
Lower Columbia River	17080006	Columbia River	The most downstream watershed of the Columbia River, includes a large northwest portion of Clatsop County	678
Lower Columbia-Clatskanie	17080003	Columbia River	Begins at the confluence with the Multnomah Channel and is comprised of the watersheds of the Kalama and Clatskanie Rivers. A small northeast portion of Clatsop County falls within this watershed	908

Table 5: Basin Characteristics, con't

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (square miles)
Necanicum River	17100201	Necanicum River	The northern most watershed along Oregon's coastline, which is defined by the mouth of the Columbia to the north and the mouth of the Nehalem to the south	316
Nehalem River	17100202	Nehalem River	Flows through the southeast third of Clatsop County, begins in the Coastal Range and ends at the mouth in the Pacific Ocean	855

4.2 Principal Flood Problems

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

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems[1]
All sources	Flooding in Clatsop County primarily occurs during the winter months, particularly in the low-lying coastal and estuary areas. The extensive flooding in these areas is a result of high spring tides and strong winds from winter storms. The storms that produce the storm surges also bring heavy rains; therefore, the high riverflows are held back by tides, producing the greatest flooding at river mouths. High tides and riverflows close tide gates on dikes, often for extended periods. While tide gates are closed, storm runoff accumulates and floods the flat, low-lying floodplain areas. Extreme high water often overtops or breaches poorly maintained dike.
Columbia River, Youngs Bay, and Lewis and Clark River	Riverflow and the effects of coastal storms and tides combine to cause flood hazards in the City of Astoria. When water levels are high in either the Columbia River or Youngs Bay, the tide gates in the levees do not open to allow the water which has accumulates behind the levees to escape. If the water levels in either the river or bay remain high for a period of time, flooding can occur behind the dikes from the accumulation of local runoff. This problem exists in several areas. Flooding in Warrenton is also caused by the influence of astronomical tides and storm surge on the discharge of area streams. The Lewis and Clark River causes flood hazards in the east part of Warrenton when the levees along the river are overtopped.
Pacific Ocean	The primary source of flooding in Cannon Beach is the Pacific Ocean. High astronomical tides topped with surges and waves caused by strong winds of winter storms are responsible for coastal flooding. The large waves run up onto ocean beaches to flood shoreline structures. Furthermore, wave setup on top of storm surge and high tide combine in Ecola Creek to back up streamflow and cause flooding in lowlands. In Gearhart large waves run up the narrow ocean beach to flood coastal properties. In Seaside flood damage in tidal and coastal areas is a result of high

Table 6: Principal Flood Problems, con't

Flooding Source	Description of Flood Problems[1]
	stillwater levels and wave action. The stillwater level is caused by astronomical tides and storm surges. Wave action produces a rise in water level, due to shoreward mass transport of the water, which is called wave runup or setup. In addition, wave runup, after breaking, produces flooding, and the velocity of the wave causes damage above the stillwater level of the flood.
Ecola Creek	Ecola Creek (formerly Elk Creek) is a flood source in Cannon Beach when higher-than-normal flows in the creek occur in conjunction with very high tides caused by coastal storms. Wave setup on top of storm surge and high tide combine in Ecola Creek to back up streamflow and cause flooding in lowlands.
Neacoxie Creek	Neacoxie Creek flows through the central city area of Gearhart and drains into the Neawanna Creek-Necanicum River estuary area. The portion of Gearhart lying east of U.S. Highway 101 drains southerly through several small surface drainageways, which combine and empty into Neawanna Creek through several parallel tidal gates. A major source of flooding is created when the drainageways and/or tidal gates become obstructed with debris. The estuary becomes a flooding source by backing up higher-than-normal flows from Neacoxie Creek, with very high tides caused by coastal storms and high flow from the Necanicum River.
Necanicum River	During high floods, the Necanicum River overflows its banks and flows west into the Circle Creek floodplain in the City of Seaside. This happens at various locations from above the corporate limits northwards to the Seaside Golf Course. From Peterson Point north to the Seaside Golf Course, floodwaters from the Necanicum River overflows U.S. Highway 101 and into the Beerman Creek floodplain east of the city. Floodwater from Necanicum River also flows eastward under Dooley Bridge into the Neawanna Creek floodplain. The estuary experiences flooding when higher-than-normal flows back up when corresponding with very high tides caused by coastal storms.

[1]From Clatsop County FIS Report effective 9/17/2010 (FEMA 2010)

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

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak[1]	Event Date	Approximate Recurrence Interval (years)	Source of Data
Fishhawk Creek at Jewell	4700 feet downstream from Tidewater Road	19.0	December 4, 1975	N/A	USGS gage 14300400
Youngs River	3000 feet upstream of Youngs River Road	13.7	February 10, 1949	N/A	USGS gage 14251500
Bear Creek	3000 feet upstream of Headworks Road	3.4	January 11, 1972	N/A	USGS gage 14248700
Little Creek	At Hillcrest Loop	14.4	December 13, 1977	N/A	USGS gage 14248510
Big Creek	2300 feet upstream of Hillcrest Loop	4.0	February 24, 1950	N/A	USGS gage 14248500

[1]In feet relative to gage datum

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Clatsop 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
Lewis and Clark River	Diking Districts # 11, 8, 5, & 2	Dike	Various locations	Not high enough to completely prevent flooding
Youngs River	Diking Districts # 3 & 9	Dike	Various locations	Not high enough to completely prevent flooding
Klaskanine River	Diking Districts # 9	Dike	Along the Klaskanine River	Not high enough to completely prevent flooding
Wallooskee River and Little Wallooskee River	Diking Districts # 13	Dike	At the confluence of the flooding sources	Not high enough to completely prevent flooding
John Day River	Diking Districts # 14	Dike	Along the John Day River	Not high enough to completely prevent flooding

Table 8: Non-Levee Flood Protection Measures, con't

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Blind Slough, Grizzly Slough, and Columbia River	Diking Districts # 1, 4, & 7	Dike	Various locations	Not high enough to completely prevent flooding
Westport Slough	Diking Districts # 15	Dike	Along the Westport Slough	Not high enough to completely prevent flooding
Pacific Ocean	N/A	Seawall and riprap	City of Seaside shoreline	Not high enough to completely prevent flooding

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 no 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 Clatsop 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 the information presented in Table 9 is subject to change at any time. For that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE national levee database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 31.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Clatsop County (Unincorporated Areas)	Blind Slough, Columbia River	Left Bank	Levee District	Yes	5005000017 (Clatsop 1 and 7)	N/A	41007C0285E	Minimally Acceptable
City of Warrenton	Alder Creek, Columbia River	Left Bank	City of Warrenton	Yes	5005000016 (Warrenton 1 North)	N/A	41007C0204E, 41007C0208E, 41007C0216E	PAL
City of Warrenton	Skipanon River	Left Bank	City of Warrenton	Yes	5005000045 (Warrenton 1 South)	N/A	41007C0216E	PAL

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 27, “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. 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.) 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	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Bear Creek	At Columbia River Highway	13.1	848	1,272	1,467	2,022
Beerman Creek	Upstream end	2.66	1,207	1,634	1,665	1,956
Big Creek	At Old U.S. Highway 30	33.3	2,086	2,646	2,864	3,373
Cow Creek	At mouth on Nehalem River	3.9	490	570	610	710
Fishhawk Creek at Birkenfeld	At Greasy Spoon Road	22.7	2,250	2,650	2,850	3,300
Fishhawk Creek at Jewell	At mouth on Nehalem River (Beneke Creek)	62.0	5,350	6,350	6,800	7,850
	At mouth on Beneke Creek	36.3	2,450	2,900	3,100	3,550
Humbug Creek	At mouth on Nehalem River	29.5	3,900	4,800	5,100	5,900
Lewis and Clark River	At mouth on Youngs Bay	62.0	4,480[1]	5,300[1]	5,680[1]	6,550[1]
	At Chadwell	49.7	4,448	5,300	5,680	6,550
	At confluence with Stavebolt Creek	44.6	4,080	4,820	5,170	5,960
	At confluence with Shweeash Creek	33.4	3,180	3,760	4,030	4,650

Table 10: Summary of Discharges, con't

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Little Creek	At Old U.S. Highway 30	4.5	334	453	503	620
Little Wallooskee River	At Wallooskee Loop Road	2.7	360	430	460	525
	At Cross Section E	1.0	150	183	196	224
Neacoxie Creek	At Golf Course Road	3.68	278	382	420	520
Neawanna Creek (Lower)	Upstream end	0.75	465	630	642	754
Neawanna Creek (Upper)	At confluence with Neawanna Creek (Lower)	0.75	465	630	642	754
Necanicum River	Above Neawanna Creek (Upper)	66.6	13,526	18,307	18,657	21,922
	Above Beerman Creek	62.4	12,877	17,428	17,761	20,870
	New Junction of US 101 and US 26	54.9	11,693	15,826	16,128	18,951
	Klootchie Creek	48.4	10,900	13,600	14,700	17,300
	At confluence with South Fork Necanicum River	37.2	8,800	11,100	12,100	14,300
	At confluence with North Fork Necanicum River	24.0	6,400	8,000	8,700	10,300

Table 10: Summary of Discharges, con't

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)			
			10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Nehalem River	At confluence with Humbug Creek	538.0	30,000	38,000	42,750	50,150
	At Sunset Highway (Jewell Junction)	498.0	26,700	33,800	38,000	44,600
	At Nehalem Highway Bridge (River Mile 50.0)	398.0	25,150	31,925	35,850	41,900
	At Nehalem Highway Bridge (River Mile 62.0)	363.6	22,500	28,800	32,000	37,600
North Fork Nehalem River	At Aldervale (County Road Ridge)	75.1	8,780	12,400	14,100	17,900
	At confluence with Grassy Lake Creek	62.0	7,970	11,700	13,400	17,300
	At Hop'n Scotchit Road	16.5	2,596	3,068	3,293	3,798
Northrup Creek	At mouth on Nehalem River	12.6	1,350	1,600	1,700	2,000
Plympton Creek	At mouth on Columbia River	10.0	650	885	980	1,200

[1]Flow is reduced due to restrictions from dikes and levees

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
Asbury Creek	14299500	USGS	Asbury Creek Near Cannon Beach, OR	2.0	10/1/1951	9/30/1977
Bear Creek	14248700	USGS	Bear Creek Near Svensen, OR	3.33	08/01/1965	09/30/1975
Big Creek	14248500	USGS	Big Creek Near Knappa, OR	31.9	10/1/1949	9/30/1955
Fall Creek	14247020	USGS	Fall Creek Near Clatskanie, OR	2.1	10/1/1971	9/30/1984*
Fishhawk Creek	14300400	USGS	Fishhawk Creek Near Jewell, OR	0.7	10/1/1970	9/30/1977
Little Creek	14248510	USGS	Little Creek Near Knappa, OR	1.5	10/1/1971	9/30/1984*
Nehalem River	14301000	USGS	Nehalem River Near Foss, OR	667.0	12/16/1939	Present*
Nestucca River	14303600	USGS	Nestucca River Near Beaver, OR	180.0	10/1/1964	Present*
North Fork Klaskanine River	14252000	USGS	North Fork Klaskinine River Near Olney, OR	14	10/1/1949	9/30/1955
North Fork Necanicum River	14298500	USGS	North Fork Necanicum River Near Seaside, OR	Unknown	10/1/1951	9/30/1952
Oak Ranch Creek	14300200	USGS	Oak Ranch Creek Near Vernonia, OR	11.6	10/1/1958	9/30/1968

Table 12: Stream Gage Information used to Determine Discharges, con't

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Siletz River	14305500	USGS	Siletz River Near Siletz, OR	202.0	10/1/1905	Present*
Wilson River	14301500	USGS	Wilson River Near Tillamook, OR	161.0	12/1/1914	Present*
Youngs River	14251500	USGS	Youngs River near Astoria, OR	40.1	10/01/1927	09/30/1958

*Full period of record was not used to determine discharges

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	Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Bear Creek	1280 feet downstream of Old Hwy 30	1105 feet upstream of Old Hwy 30	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Beerman Creek	Confluence with the Necanicum River	2600 feet downstream of Necanicum Mainline Road	Log Pearson Type III Frequency Analysis[1]	HEC-RAS 3.1.2	June 2007	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Big Creek	2400 feet downstream of Old Hwy 30	1300 feet upstream of Hwy 30	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Cow Creek	Confluence with Nehalem River	1900 feet downstream of Hidden Spring Drive	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Fishhawk Creek at Birkenfeld	550 feet downstream of Sjoli Ln	1430 feet downstream of North Shore Drive	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Fishhawk Creek at Jewell	Confluence with Nehalem River	2180 feet upstream of Hwy 103	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Humbug Creek	Confluence with Nehalem River	3360 feet downstream of Kampy Lane	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.

Table 13: Summary of Hydrologic and Hydraulic Analyses, con't

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
Lewis and Clark River	965 feet downstream of Walford Johnson Creek	1965 feet upstream of Shweeash Creek	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Little Creek	1415 feet downstream of Old Hwy 30	1020 feet upstream of US Hwy 30	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Little Wallooskee River	1080 feet downstream of Little Walluski Lane	2700 feet upstream of Little Walluski Lane	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Neacoxie Creek	730 feet downstream of G St	930 feet upstream of Surf Pines Lane	Anecdotal	HY-8	Sept. 1995	AE	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Neawanna Creek (Lower)	730 feet downstream of 12th Avenue	At US Hwy 101	Log Pearson Type III Frequency Analysis[1]	HEC-RAS 3.1.2	June 2007	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Neawanna Creek (Upper)	Confluence with Neawanna Creek (Lower)	880 feet upstream of Wahanna Road	Log Pearson Type III Frequency Analysis[1]	HEC-RAS 3.1.2	June 2007	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Necanicum River	6500 feet upstream of U.S. Highway 101	2920 feet downstream the confluence with Little Humbug Creek	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Necanicum River	575 feet downstream of 12th Ave	6500 feet upstream of U.S. Highway 101	Log Pearson Type III Frequency Analysis[1]	HEC-RAS 3.1.2	June 2007	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.

Table 13: Summary of Hydrologic and Hydraulic Analyses, con't

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
Necanicum River Overflow	710 feet downstream of Rippett Lane	2475 feet downstream of US Hwy 101	Log Pearson Type III Frequency Analysis[1]	HEC-RAS 3.1.2	June 2007	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Nehalem River	4250 feet upstream of Fema Road	2975 feet upstream of Grub Creek	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
North Fork Nehalem River	740 feet upstream of Boykin Creek	1185 feet upstream of Bridge Lane	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
North Fork Nehalem River at Hamlet	2045 feet upstream of Hamlet Road	205 feet downstream of Layton Road	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Northrup Creek	Confluence with Nehalem River	3475 feet of Northrup Creek Rd crossing of Unnamed Tributary	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.
Plympton Creek	Confluence with Westport Slough	570 feet upstream of US Hwy 30	Log Pearson Type III Frequency Analysis[1]	HEC-2	May 1977	AE w/ Floodway	Detailed study including bathymetric field survey, land use roughness considerations, and hydraulic structure dimensions.

[1]WRC 1981

Table 14: Roughness Coefficients

Flooding Source	Channel “n”	Overbank “n”
Bear Creek	0.030-0.055	0.035-0.150
Beerman Creek	0.030-0.055	0.035-0.150
Big Creek	0.030-0.055	0.035-0.150
Cow Creek	0.030-0.055	0.035-0.150
Fishhawk Creek at Birkenfeld	0.030-0.055	0.035-0.150
Fishhawk Creek at Jewell	0.030-0.055	0.035-0.150
Humbug Creek	0.030-0.055	0.035-0.150
Lewis and Clark River	0.030-0.055	0.035-0.150
Little Creek	0.030-0.055	0.035-0.150
Little Wallooskee River	0.030-0.055	0.035-0.150
Neacoxie Creek	Not Published	Not Published
Neawanna Creek (Lower)	0.030-0.055	0.035-0.150
Neawanna Creek (Upper)	0.030-0.055	0.035-0.150
Necanicum River	0.030-0.055	0.035-0.150
Necanicum River Overflow	0.030-0.055	0.035-0.150
Nehalem River	0.030-0.055	0.035-0.150
North Fork Nehalem River	0.030-0.055	0.035-0.150
North Fork Nehalem River at Hamlet	0.030-0.055	0.035-0.150
Northrup Creek	0.030-0.055	0.035-0.150
Plympton Creek	0.030-0.055	0.035-0.150

5.3 Coastal Analyses

For the areas of Clatsop 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
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Storm Surge	Statistical analyses of non-tidal residuals derived from measured tides (40-year record)	July 2011
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Stillwater Levels	Statistical analyses of non-tidal residuals derived from measured tides (40-year record) with GEV/Peak-over-threshold statistical analysis	July 2011
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Dune Erosion Analysis	Kriebel and Dean 1993	January 2012
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Wave Generation	Measured time series of waves derived from NDBC buoys – 30-year record	January 2012
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Wave Modeling	SWAN	January 2012
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Wave Setup	Intergrated in the Stockdon et al. 2006 wave runup calculation. Can be calculated from equation #10 in Stockdon.	July 2013
Pacific Ocean	Entire coastline of Clatsop County	Entire coastline of Clatsop County	Wave Runup	Stockdon et al. 2006/TAW (van der Meer 2002) with GEV/Peak-over-threshold statistical analysis	July 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 coastal analyses is shown in Table 17, "Coastal Transect Parameters." When applicable, Figure 8 would show the total stillwater elevations for the 1% annual chance flood that was determined for this coastal analysis.

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

[Not Applicable to this FIS Project]

Astronomical Tide

Astronomical tidal statistics were generated directly from the measured tides using the harmonic analysis method of least squares approach (Boon 2004) to estimate the amplitude and phase for any set of tidal constituents in Matlab. This approach was used to define the predicted tides, which were then subtracted from the measured tides to yield non-tidal residuals used to assess the frequency and magnitudes of storms surges on the Oregon coast.

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.

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.

Table 16: Tide Gage Analysis Specifics

Gage Name	Managing Agency of Tide Gage Record	Gage Type	Start Date	End Date	Statistical Methodology
9435380	NOAA	Tide	1967	2005	Peak-Over-Threshold
9437540	NOAA	Tide	2005	2011	Peak-Over-Threshold

Wave Setup Analysis

Wave setup was computed during the storm surge modeling through the methods and models listed in Table 15 and included in the frequency analysis for the determination of the total stillwater elevations. In all cases Stockdon et al., (2006) was used to derive calculations of the wave runup and ultimately the total water level for dune-backed beaches. For beaches backed with structures or bluffs, Stockdon was used to initially calculate the 2% water level at the structure or bluff toe and subsequently the bore height.

5.3.2 Waves

SWAN (Simulating WAves Nearshore) version number 40.81, a third generation wave model developed at the Technical University of Delft in the Netherlands (Booij et al. 1999; Ris et al. 1999), was used in this study. The model solves the spectral action balance equation using finite differences for a spectral or parametric input specified along the boundaries. The SWAN runs were executed in stationary mode and included physics that account for shoaling, refraction, and breaking. A matrix of SWAN runs were executed in order to assist with the development of a lookup table for transforming waves offshore from Clatsop County.

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. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

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 9A to 9D, "Transect Location Maps," are also depicted on the FIRM. Table 17 provides the location, stillwater elevations, and total water levels for each transect.

Wave Height Analysis

Wave height analyses are 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.

Overland wave propagation is not applicable to this FIS project.

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. In all cases Stockdon et al., (2006) was used to derive calculations of the wave runup and ultimately the total water level for dune-backed beaches. For Beaches back with structures or bluffs, TAW was used with the local structure slope to calculate the wave runup on the structure or bluff face.

Table 17: Pacific Ocean Transect Parameters

Transect	Total Water Levels (ft NAVD88)				Starting Stillwater Elevations (ft NAVD88)	
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% Annual Chance	0.2% Annual Chance
01	33.1	37.2	39.1	43.9	11.8	12.1
02	29.8	32.7	33.9	36.6	11.8	12.1
03	29.4	31.3	32	33.4	11.8	12.1
04	28	29.3	29.8	30.8	11.8	12.1
05	25.7	28.5	29.7	32.3	11.8	12.1
06	28.8	30.8	31.5	33	11.8	12.1
07	30.7	33.5	34.6	37.1	11.8	12.1
08	27.6	29.8	30.7	32.7	11.8	12.1
09	35.4	36.9	37.4	38.4	11.8	12.1
10	33.4	34.6	34.9	35.3	11.8	12.1
11	22.3	23.8	24.4	25.6	11.8	12.1
12	27	29.2	30.1	32.1	11.8	12.1
13	31.1	35	36.6	40	11.8	12.1
14	29.9	32.3	33.3	35.4	11.8	12.1
15	27.8	30.6	31.8	34.7	11.8	12.1
16	23.9	25.5	26.1	27.3	11.8	12.1
17	20.4	21.8	22.3	23.4	11.8	12.1
18	22.3	25.6	27.2	31.4	11.8	12.1

Table 17: Pacific Ocean Transect Parameters, con't

Transect	Total Water Levels (ft NAVD88)				Starting Stillwater Elevations (ft NAVD88)	
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% Annual Chance	0.2% Annual Chance
19	19.3	20.5	21	22	11.8	12.1
20	21.8	25.6	27.6	32.8	11.8	12.1
21	19.8	21.1	21.6	22.7	11.8	12.1
22	23.3	27.4	28.9	32.1	11.8	12.1
23	19.9	21.2	21.7	22.7	11.8	12.1
24	19.7	21.1	21.6	22.7	11.8	12.1
25	20.2	22.5	23.5	26	11.8	12.1
26	20.6	22.7	23.6	25.8	11.8	12.1
27	20.8	24	25.6	29.9	11.8	12.1
28	19.4	20.8	21.3	22.5	11.8	12.1
29	19.4	20.7	21.2	22.3	11.8	12.1
30	19.5	20.6	21	21.8	11.8	12.1
31	23	27.2	28.9	32.9	11.8	12.1
32	22.8	25.2	25.9	27.3	11.8	12.1
33	21.3	24.4	25.8	29.7	11.8	12.1
34	18.2	22.9	25.2	31.1	11.8	12.1
35	21.7	25.4	27.3	32.4	11.8	12.1
36	24.8	27.9	28.9	30.7	11.8	12.1
37	24.6	28.5	30	33.2	11.8	12.1

Table 17: Pacific Ocean Transect Parameters, con't

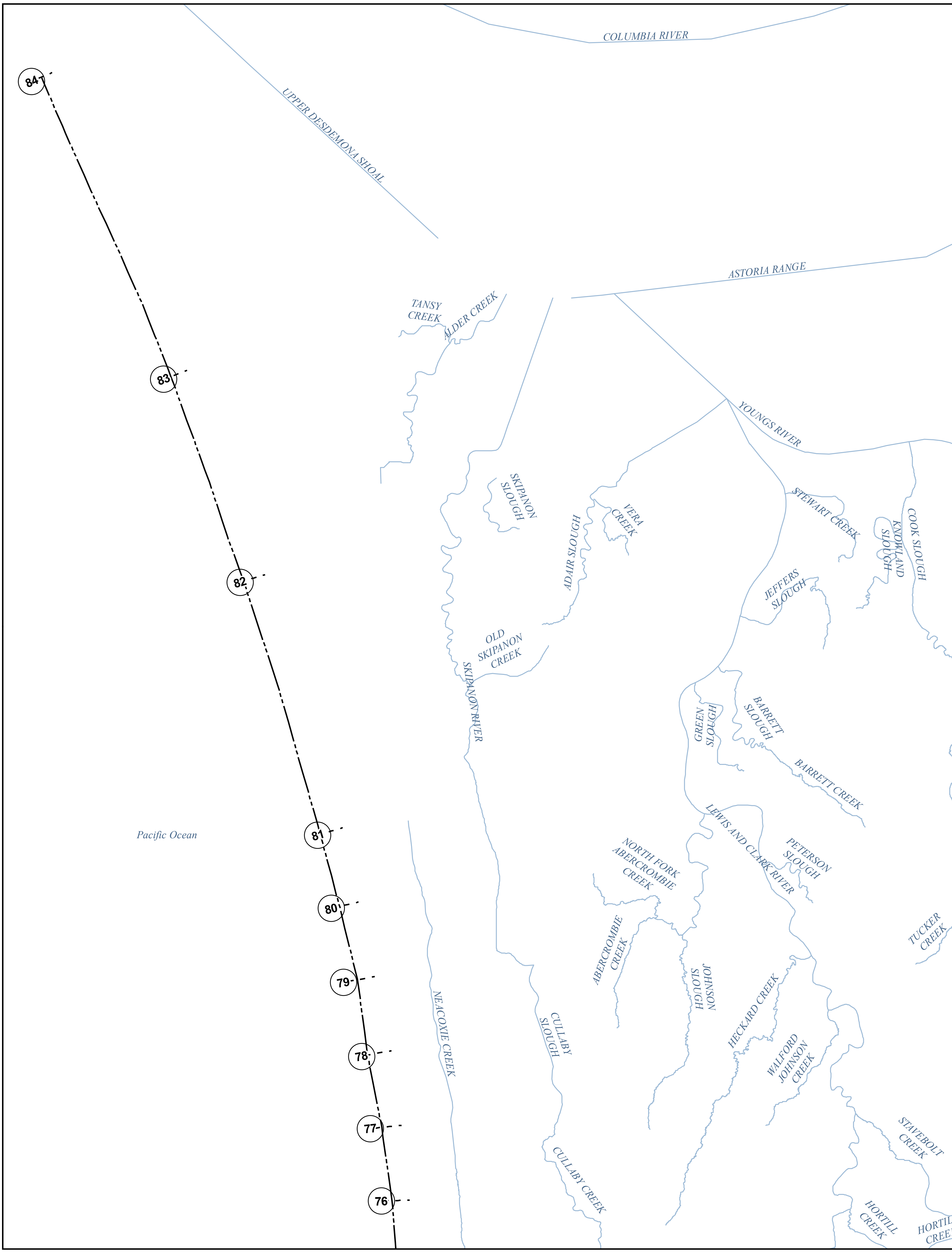
Transect	Total Water Levels (ft NAVD88)				Starting Stillwater Elevations (ft NAVD88)	
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% Annual Chance	0.2% Annual Chance
38	26.9	30.7	32.2	35.2	11.8	12.1
39	21.6	25.4	27.4	32.9	11.8	12.1
40	20.8	23.5	24.8	28	11.8	12.1
41	19.8	21.1	21.6	22.6	11.8	12.1
42	23.4	30	33.8	45.8	11.8	12.1
43	20.5	22.4	23.2	25	11.8	12.1
44	20.2	21.5	22	23	11.8	12.1
45	31.8	36.7	38.6	42.6	11.8	12.1
46	19.8	21.2	21.7	22.9	11.8	12.1
47	22.4	23.9	24.5	25.6	11.8	12.1
48	25.3	31	34.1	43.3	11.8	12.1
49	23.4	27.3	28.8	32.4	11.8	12.1
50	18.8	19.9	20.3	21.2	11.8	12.1
51	21	22.5	23.1	24.3	11.8	12.1
52	21.7	23.1	23.6	24.7	11.8	12.1
53	20.3	21.6	22.2	23.2	11.8	12.1
54	26	26.4	26.5	26.6	11.8	12.1
55	28.5	28.8	28.9	29.1	11.8	12.1
56	31.6	32.4	32.6	33.1	11.8	12.1

Table 17: Pacific Ocean Transect Parameters, con't

Transect	Total Water Levels (ft NAVD88)				Starting Stillwater Elevations (ft NAVD88)	
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% Annual Chance	0.2% Annual Chance
57	19.8	21	21.5	22.4	11.8	12.1
58	20.9	22.4	23	24.2	11.8	12.1
59	21.9	23.3	23.9	25	11.8	12.1
60	19.6	20.9	21.4	22.6	11.8	12.1
61	18.6	19.8	20.3	21.3	11.8	12.1
62	18.2	19.3	19.8	20.6	11.8	12.1
63	18.8	19.9	20.4	21.2	11.8	12.1
64	18.9	20.2	20.6	21.6	11.8	12.1
65	18.1	19.3	19.8	20.7	11.8	12.1
66	17.7	18.9	19.3	20.3	11.8	12.1
67	15.9	17.2	17.5	18	11.8	12.1
68	17	17.6	17.8	18.4	11.8	12.1
69	25.3	26.3	26.6	26.9	11.8	12.1
70	17.4	18.1	18.3	18.7	11.8	12.1
71	20.6	22.1	22.7	23.9	11.8	12.1
72	19.7	21	21.5	22.5	11.8	12.1
73	19.3	20.7	21.3	22.6	11.8	12.1
74	19.5	20.7	21.2	22.2	11.8	12.1
75	19	20.1	20.6	21.5	11.8	12.1

Table 17: Pacific Ocean Transect Parameters, con't

Transect	Total Water Levels (ft NAVD88)				Starting Stillwater Elevations (ft NAVD88)	
	10% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance	1% Annual Chance	0.2% Annual Chance
76	19.7	21.1	21.7	22.9	11.8	12.1
77	19.9	21.4	21.9	23.1	11.8	12.1
78	19.5	20.8	21.3	22.3	11.8	12.1
79	19.6	21	21.6	22.8	11.8	12.1
80	19.3	20.7	21.2	22.4	11.8	12.1
81	20	21.5	22.1	23.4	11.8	12.1
82	19.6	21.2	21.9	23.4	11.8	12.1
83	19.9	21.4	22	23.3	11.8	12.1
84	20.8	22.7	23.5	25.3	11.8	12.1



N

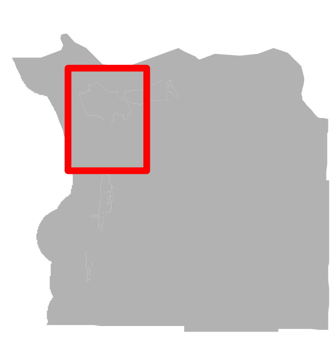
1 inch equals 0.9 miles

Miles

0 0.8 1.6

Map Projection:
NAD 1983 UTM Zone 10N
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map Number 1 - Figure 9A

PANELS WITH TRANSECTS:

200, 205, 212, 214, 215, 352, 355, 356, 358, 366, 368, 502, 505, 512, 514, 515, 652, 654, 662, 665

FEMA

N

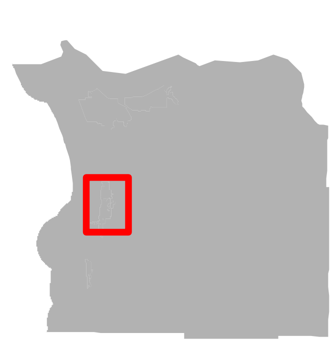
1 inch equals 0.5 miles

Miles

0 0.4 0.8

Map Projection:
NAD 1983 UTM Zone 10N
North American Datum 1983

COUNTY LOCATOR



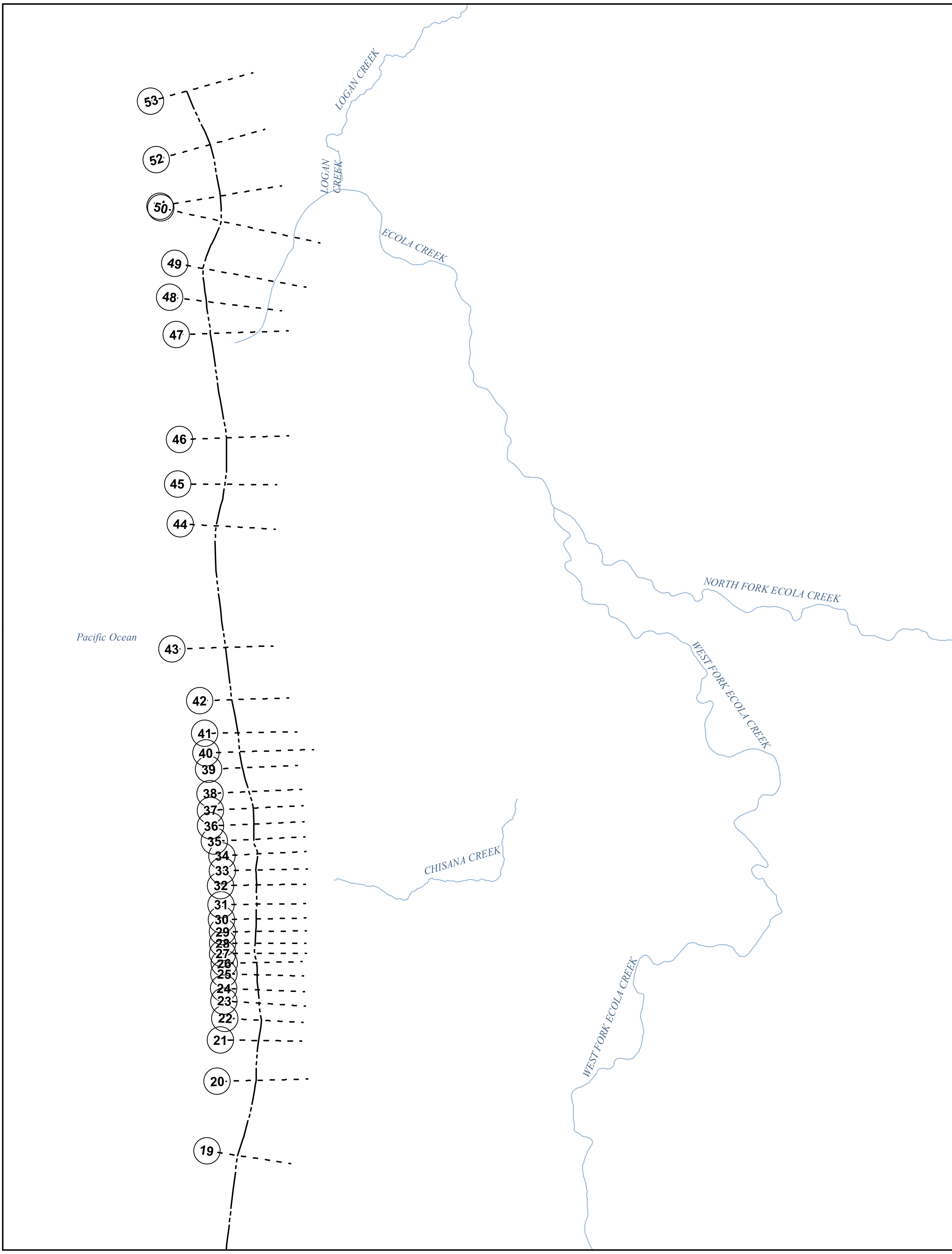
NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map Number 2 - Figure 9B

PANELS WITH TRANSECTS:

200, 205, 212, 214, 215, 352, 355, 356, 358, 366, 368, 502, 505, 512, 514, 515, 652, 654, 662, 665

FEMA



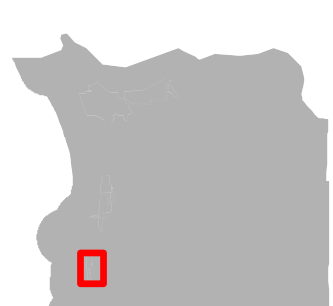
1 inch equals 0.3 miles

N

Miles
0 0.25 0.5

Map Projection:
NAD 1983 UTM Zone 10N
North American Datum 1983

COUNTY LOCATOR



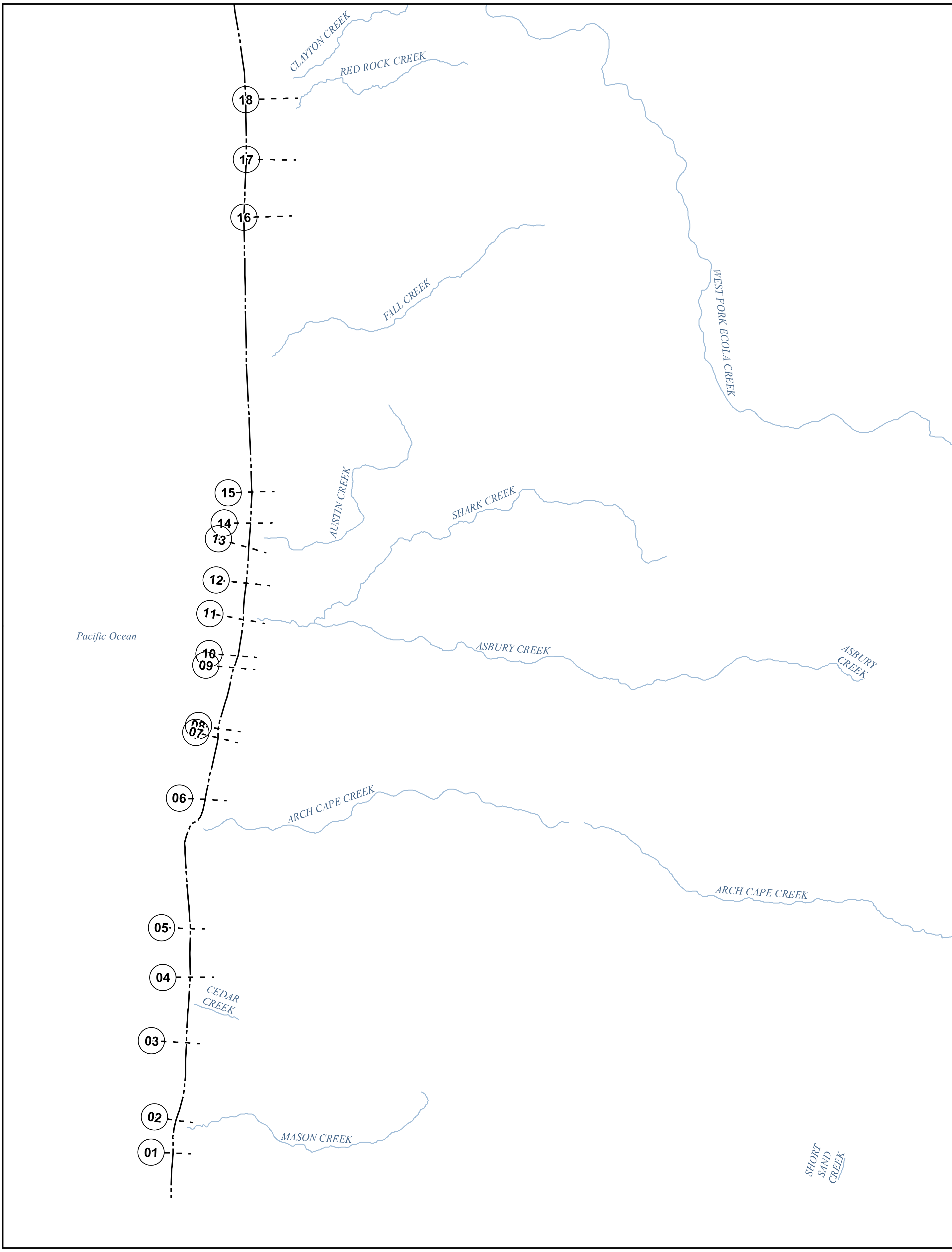
NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map Number 3 - Figure 9C

PANELS WITH TRANSECTS:

200, 205, 212, 214, 215, 352, 355, 356, 358, 366, 368, 502, 505, 512, 514, 515, 652, 654, 662, 665

FEMA



1 inch equals 0.4 miles

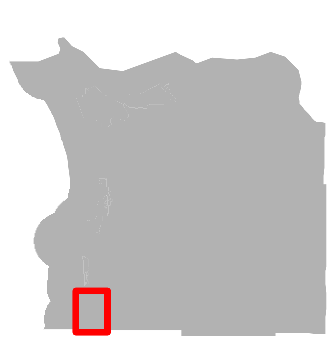
N

Miles

0 0.3 0.6

Map Projection:
NAD 1983 UTM Zone 10N
North American Datum 1983

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

Transect Locator Map Number 4 - Figure 9D

PANELS WITH TRANSECTS:

200, 205, 212, 214, 215, 352, 355, 356, 358, 366, 368, 502, 505, 512, 514, 515, 652, 654, 662, 665

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.

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

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the 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.

Table 20: Countywide Vertical Datum Conversion

[Not Applicable to this FIS Project]

Table 21: Stream-by-Stream Vertical Datum Conversion

[Not Applicable to this FIS Project]

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
Lidar collected in 2007, 2009, and 2010.	Oregon Department of Geology and Mineral Industries	2011	1:2,500	Hillshade and slope derivatives of 1-meter resolution LiDAR DEMs were used to create the base map.
Oregon statewide 1-meter NAIP orthoimagery	Oregon Department of Administrative Services, Geospatial Enterprise Office	2009	1:2,500	Where LiDAR was not available, this orthophoto was used to infill the base map.
Hydrography	Oregon Department of Geology and Mineral Industries	2011	1:2,500	Stream centerlines and water bodies digitized from LiDAR collected 2007-2010.
National Hydrographic Dataset	U.S. Geological Survey	2011	1:24,000	Where LiDAR was not available, the National Hydrographic Dataset was incorporated and snapped to hydrography digitized by DOGAMI.

Table 22: Base Map Sources, con't

Data Type	Data Provider	Data Date	Data Scale	Data Description
Hydraulic structures	Oregon Department of Geology and Mineral Industries	2011	1:2,500	Hydraulic structures (mainly bridges and culverts) digitized from LiDAR collected 2007-2010. Used Oregon Department of Transportation bridge layer and Oregon Department of Fish and Wildlife fish passage barrier layer to locate structures.
Dams	U.S. Army Corps of Engineers	2010	1:24,000	Dams created by the U.S. Army Corps of Engineers in 2010 and downloaded from the Oregon Geospatial Data Clearinghouse.
Roads	Clatsop County, OR	2011	1:2,400	Transportation road features provided by the county.
Railroads	Oregon Department of Transportation	2010	1:24,000	Railroad features created by the Oregon Department of Transportation in 2010 and downloaded from the Oregon Geospatial Data Clearinghouse.
Tidegates	Oregon Department of Land Conservation and Development	2011	1:2,500	Tidegates created by the Oregon Department of Land Conservation and Development in 2011 and downloaded from the Oregon Coastal Atlas.
Levees	Oregon Department of Land Conservation and Development	2011	1:2,500	Coastal levees created by the Oregon Department of Land Conservation and Development in 2011 and downloaded from the Oregon Coastal Atlas.
Land ownership, city limits, parks, and public land survey sections	Clatsop County, OR	2011	1:24,000	Municipal and county boundaries, and PLS section data provided by Clatsop County.
Urban growth boundaries	Oregon Department of Land Conservation and Development	2012	1:24,000	Urban growth boundaries created the Oregon Department of Land Conservation and Development in 2012 and downloaded from the Oregon Geospatial Data Clearinghouse.

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."

Certain flooding sources may have been studied that do not have published BFEs on the FIRMs, or for which there is a need to report the 1% annual chance flood elevations at selected cross sections because a published Flood Profile does not exist in this FIS Report. These streams may have also been studied using methods to determine non-encroachment zones rather than floodways. For these flooding sources, the 1% annual chance floodplain boundaries 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. All topographic data used for modeling or mapping has been converted as necessary to NAVD 88. The 1% annual chance elevations for selected cross sections along these flooding sources, along with their non-encroachment widths, if calculated, are shown in Table 25, "Flood Hazard and Non-Encroachment Data for Selected Streams."

Table 23: Summary of Topographic Elevation Data used in Mapping

		Source for Topographic Elevation Data			
Community	Flooding Source	Description	Scale	Contour Interval	Citation
Clatsop County and Incorporated Areas	All flooding sources except upper portion of Necanicum River and Fishhawk Creek at Birkenfeld	LiDAR	1:2,500	1 ft	OLC 2007-2010

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.

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	6,850	588	11,599	1.6	13.4	13.4	14.4	1.0
B	7,595	229	3,230	4.2	13.6	13.6	14.6	1.0
C	8,450	277	7,647	3.4	14.0	14.0	15.0	1.0
D	9,330	1,055	6,866	1.0	14.4	14.4	15.3	0.9
E	10,496	380	3,452	2.1	14.5	14.5	15.4	0.9
F	10,849	190	1,669	4.3	14.7	14.7	15.7	1.0
G	11,770	537	4,255	1.7	15.2	15.2	16.1	0.9
H	12,711	535	3,946	1.8	15.4	15.4	16.3	0.9
I	13,622	771	5,614	1.3	15.6	15.6	16.6	1.0
J	14,723	598	6,426	1.1	15.8	15.8	16.8	1.0
K	15,312	605	4,804	1.5	15.8	15.8	16.8	1.0
L	15,634	581	3,041	2.4	15.9	15.9	16.9	1.0
M	16,289	1,366	10,402	0.7	16.2	16.2	17.2	1.0
N	16,969	973	7,976	0.9	16.2	16.2	17.2	1.0
O	17,715	1,430	11,418	0.6	16.3	16.3	17.3	1.0
P	18,981	1,181	7,919	0.9	16.6	16.6	17.6	1.0
Q	19,339	1,664	9,558	1.4	18.9	18.9	19.4	0.5

[1]Feet above confluence with Necanicum River

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NEAWANNA CREEK (LOWER)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	0	213	296	2.2	16.2[2]	11.9[3]	12.9	1.0
B	681	85	172	3.7	16.6	16.6	17.5	0.9
C	834	121	262	2.5	19.1	19.1	20.0	0.9
D	1,709	33	145	4.4	31.6	31.6	32.1	0.5

[1]Feet above confluence with Neawanna Creek (Lower)
[2]Backwater effects from Neawanna Creek (Lower)
[3]Elevation without consideration of backwater effect from Neawanna Creek (Lower)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NEAWANNA CREEK (UPPER)

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
A	2,890	257	2,577	4.5	11.8	11.0[2]	12.0[2]	1.0
B	3,475	222	2,644	4.4	11.8	11.5[2]	12.3[2]	0.8
C	3,662	279	3,212	3.6	11.8	11.7[2]	12.5[2]	0.8
D	4,672	308	3,334	3.5	12.2	12.2	12.8	0.6
E	5,549	277	3,430	3.4	12.5	12.5	13.1	0.6
F	6,103	174	2,495	4.6	12.7	12.7	13.2	0.5
G	6,611	117	2,292	5.1	13.1	13.1	13.5	0.4
H	6,998	145	2,526	4.6	13.5	13.5	13.8	0.3
I	7,638	266	3,177	3.6	13.9	13.9	14.1	0.2
J	8,062	196	2,806	4.1	14.0	14.0	14.2	0.2
K	9,200	485	5,064	2.3	14.5	14.5	14.7	0.2
L	9,917	200	1,991	5.8	14.5	14.5	14.7	0.2
M	10,941	255	2,318	5.0	15.6	15.6	15.6	0.0
N	11,895	171	2,329	5.0	16.9	16.9	17.7	0.8
O	12,920	689	3,668	3.2	17.7	17.7	18.4	0.7
P	13,460	1,250	6,779	1.7	18.2	18.2	18.8	0.6
Q	14,497	2,150	11,351	1.0	18.6	18.6	19.1	0.5
R	15,832	2,615	16,182	0.7	18.8	18.8	19.3	0.5
S	16,735	3,493	18,943	0.6	18.9	18.9	19.3	0.4
T	18,196	3,337	16,858	1.2	19.2	19.2	19.6	0.4
U	19,562	3,298	19,769	1.0	19.4	19.4	19.8	0.4

[1]Feet above confluence with Neawanna Creek (Lower)

[2]Elevation without consideration of tidal effect from the Pacific Ocean

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NECANICUM RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
V	20,267	2,717[2]	N/A	1.1[3]	19.5	19.5	19.9	0.4
W	21,126	2,698[2]	N/A	1.2[3]	19.7	19.7	20.2	0.5
X	21,998	2,864[2]	N/A	1.8[3]	20.1	20.1	20.5	0.4
Y	23,191	2,292[2]	N/A	1.9[3]	20.7	20.7	20.9	0.2
Z	24,123	1,250[2]	N/A	3.8[3]	22.0	22.0	22.0	0.0
AA	25,337	1,147	3,235	5.0	24.7	24.7	24.8	0.1
AB	26,037	1,270	4,423	3.7	27.2	27.2	27.4	0.2
AC	26,981	858	4,154	3.9	28.9	28.9	29.1	0.2
AD	27,473	827	4,153	4.2	30.1	30.1	30.2	0.1
AE	27,956	942	1,181	9.3	31.5	31.5	31.5	0.0
AF	28,756	525	1,429	7.7	34.3	34.3	34.8	0.5
AG	29,430	375	1,253	8.7	36.4	36.4	36.9	0.5
AH	30,491	1,093	3,507	3.1	39.3	39.3	40.0	0.7
AI	31,408	875	2,603	4.2	40.4	40.4	40.8	0.4
AJ	32,136	1,300	2,472	5.1	41.9	41.9	42.1	0.2
AK	33,125	2,001	5,750	2.4	43.8	43.8	43.9	0.1
AL	33,869	1,392[2]	N/A	3.4[3]	44.6	44.6	44.6	0.0
AM	34,400	1,256[2]	N/A	4.1[3]	45.5	45.5	45.6	0.1
AN	35,059	1,165[2]	N/A	4.7[3]	47.3	47.3	47.4	0.1
AO	35,268	1,025	3,162	5.1	48.3	48.3	48.4	0.1
AP	35,983	1,197	5,321	3.1	50.1	50.1	50.2	0.1
AQ	36,187	906	4,380	3.7	51.7	51.7	51.8	0.1
AR	37,800	802	3,474	4.6	55.6	55.6	56.5	0.9

[1]Feet above confluence with Neawanna Creek (Lower)

[2]Floodway widths reflect flows along the Necanicum River as well as areas that convey flow to/from adjacent reaches

[3]Floodway velocities reflect flows along the Necanicum River and do not reflect overlows to/from adjacent reaches

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NECANICUM RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
AS	38,592	661	2,967	5.4	58.2	58.2	59.0	0.8
AT	39,431	457	2,231	7.2	61.9	61.9	62.6	0.7
AU	41,117	568	3,259	4.9	67.1	67.1	67.9	0.8
AV	43,178	695	4,899	3.1	74.5	74.5	75.4	0.9
AW	44,328	153	1,054	14.4	78.0	78.0	78.0	0.0
AX	45,328	1,056	5,964	2.6	81.5	81.5	82.4	0.9
AY	45,548	714	3,182	4.8	81.6	81.6	82.4	0.8
AZ	46,708	172	1,074	14.2	84.8	84.8	84.9	0.1
BA	47,668	264	2,200	6.9	90.1	90.1	90.2	0.1
BB	47,858	550	3,849	4.0	95.6	95.6	95.6	0.0
BC	49,258	606	3,604	4.2	96.3	96.3	96.3	0.0
BD	49,708	195	1,738	8.5	96.9	96.9	96.9	0.0
BE	50,868	417	1,519	9.7	101.8	101.8	101.8	0.0
BF	52,548	354	1,497	9.8	109.8	109.8	110.7	0.9
BG	53,828	170	1,371	9.7	115.3	115.3	116.3	1.0
BH	55,198	190	1,317	10.1	120.9	120.9	121.1	0.2
BI	56,838	158	1,180	11.3	127.6	127.6	128.1	0.5
BJ	58,198	263	1,850	7.2	134.3	134.3	135.3	1.0
BK	59,398	700	2,997	4.4	139.7	139.7	139.8	0.1
BL	60,838	459	2,345	5.7	146.7	146.7	147.6	0.9
BM	61,568	175	1,079	12.3	151.6	151.6	152.0	0.4
BN	61,798	294	1,655	8.0	156.7	156.7	156.7	0.0
BO	62,758	980	5,490	2.4	161.3	161.3	162.1	0.8

[1]Feet above confluence with Neawanna Creek (Lower)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NECANICUM RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BP	63,588	317	1,656	8.0	163.1	163.1	163.5	0.4
BQ	63,998	289	1,522	8.7	166.8	166.8	167.1	0.3
BR	64,098	650	3,450	3.9	167.6	167.6	168.6	1.0
BS	64,208	350	1,911	7.0	168.7	168.7	169.2	0.5
BT	64,508	613	5,259	2.5	171.4	171.4	172.4	1.0
BU	65,268	164	1,239	9.8	173.0	173.0	173.3	0.3
BV	65,768	358	2,300	5.3	178.2	178.2	179.2	1.0
BW	66,848	575	3,050	3.1	183.2	183.2	183.7	0.5
BX	67,038	375	1,914	5.0	183.6	183.6	184.2	0.6
BY	68,098	164	1,169	8.2	190.1	190.1	190.9	0.8
BZ	68,748	260	1,693	5.7	194.4	194.4	195.0	0.6
CA	69,618	142	925	10.4	200.1	200.1	200.4	0.3
CB	69,918	380	2,035	4.7	202.9	202.9	203.3	0.4
CC	70,403	173	1,011	9.5	205.1	205.1	206.1	1.0
CD	71,063	583	3,451	2.8	208.9	208.9	209.9	1.0
CE	71,573	165	767	12.5	214.0	214.0	214.1	0.1
CF	72,413	358	2,268	4.2	221.5	221.5	222.0	0.5
CG	73,443	541	1,466	6.5	225.3	225.3	225.3	0.0
CH	73,843	188	834	10.4	230.9	230.9	231.7	0.8
CI	74,373	341	1,980	4.4	235.4	235.4	236.4	1.0
CJ	74,623	230	972	8.9	236.5	236.5	237.5	1.0
CK	75,793	116	654	13.3	246.2	246.2	246.9	0.7
CL	76,413	460	2,300	3.8	251.8	251.8	252.8	1.0

[1]Feet above confluence with Neawanna Creek (Lower)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NECANICUM RIVER

LOCATION		FLOODWAY			1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
CM	76,613	114	718	12.1	253.6	253.6	253.7	0.1
CN	76,913	670	3,919	2.2	257.5	257.5	258.5	1.0
CO	77,193	274	862	10.1	258.3	258.3	258.7	0.4
CP	77,748	595	2,190	4.0	264.2	264.2	265.2	1.0
CQ	78,588	99	565	12.4	266.8	266.8	267.1	0.3
CR	79,368	92	516	13.6	272.1	272.1	272.1	0.0
CS	80,728	145	846	8.3	285.3	285.3	285.5	0.2
CT	81,288	224	945	7.4	289.2	289.2	289.9	0.7
CU	82,208	330	1,655	4.3	295.9	295.9	296.9	1.0
CV	82,788	109	623	11.3	298.7	298.7	299.1	0.4
CW	83,748	68	461	14.5	309.3	309.3	309.3	0.0

[1]Feet above confluence with Neawanna Creek (Lower)

TABLE 24

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLATSOP COUNTY, OREGON

AND INCORPORATED AREAS

FLOODWAY DATA

FLOODING SOURCE: NECANICUM RIVER

Table 25: Flood Hazard and Non-Encroachment Data for Selected Streams

[Not Applicable to this FIS Project]

6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the aerial extent of flooding. Sources for topographic data are shown in Table 23.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of these criteria (determined for the 1% annual chance flood condition):

- The *primary frontal dune zone* is defined in 44 CFR Section 59.1 of the NFIP regulations. The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.

- The *wave runup zone* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash zone* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation by 3.0 feet or more.

- The *breaking wave height zone* occurs where 3-foot or greater wave heights could occur (this is the area where the wave crest profile is 2.1 feet or more above the total stillwater elevation).

- The *high-velocity flow zone* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared (hv^2) is greater than or equal to 200 ft^3/sec^2. This zone may only be used on the Pacific Coast.

The SFHA boundary indicates the limit of SFHAs shown on the FIRM as either “V” zones or “A” zones.

Table 26 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

Table 26: Summary of Coastal Transect Mapping Considerations

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis *Zone Designation and BFE (ft NAVD 88)*	Wave Height Analysis *Zone Designation and BFE (ft NAVD 88)*	Zone VE Limit	SFHA Boundary
01		VE 39	N/A	Runup	N/A
02		VE 34	N/A	Runup	N/A
03		VE 32	N/A	Runup	N/A
04		N/A	VE 30, AH 23	High Velocity Flow	Ponding
05		VE 30	N/A	Runup	N/A
06		N/A	VE 32, VE 25, AE 21	High Velocity Flow	High Velocity Limit
07		VE 35	N/A	Runup	N/A
08		N/A	VE 31, VE 24, AE 22	High Velocity Flow	High Velocity Limit
09		VE 37	N/A	Runup	N/A
10		VE 35	N/A	Runup	N/A
11		N/A	VE 24, VE 16, AE 15	High Velocity Flow	High Velocity Limit
12		VE 30	N/A	Runup	N/A
13		VE 37	N/A	Runup	N/A
14		N/A	VE 33	Splash Zone	Splash Zone
15		N/A	VE 32, VE 29, AE 28	High Velocity Flow	High Velocity Limit
16		VE 26	N/A	Runup	N/A
17		VE 22	N/A	Runup	N/A
18		VE 27	N/A	Runup	N/A
19		VE 21	N/A	Runup	N/A
20		VE 28	N/A	Runup	N/A
21		VE 22	N/A	Runup	N/A
22		N/A	VE 29, VE 23, AE 22	High Velocity Flow	High Velocity Limit
23		VE 22	N/A	Runup	N/A
24		VE 22	N/A	Runup	N/A
25		VE 23	N/A	Runup	N/A
26		VE 24	N/A	Runup	N/A
27		VE 26	N/A	Runup	N/A

Table 26: Summary of Coastal Transect Mapping Considerations, con't

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis *Zone Designation and BFE (ft NAVD 88)*	Wave Height Analysis *Zone Designation and BFE (ft NAVD 88)*	Zone VE Limit	SFHA Boundary
28		VE 21	N/A	Runup	N/A
29		VE 21	N/A	Runup	N/A
30		VE 21	N/A	Runup	N/A
31		VE 29	N/A	Splash Zone	Splash Zone
32		N/A	VE 26, AE 25	High Velocity Flow	High Velocity Limit
33		VE 26	N/A	Runup	N/A
34		VE 25	N/A	Runup	N/A
35		VE 27	N/A	Runup	N/A
36		N/A	VE 29, VE 22, AE 20	High Velocity Flow	High Velocity Limit
37		N/A	VE 30, VE 21, AE 19	High Velocity Flow	High Velocity Limit
38		N/A	VE 32, VE 21, AE 20	High Velocity Flow	High Velocity Limit
39		VE 27	N/A	Runup	N/A
40		VE 25	N/A	Runup	N/A
41		VE 22	N/A	Runup	N/A
42		VE 34	N/A	Runup	N/A
43		VE 23	N/A	Runup	N/A
44	✓	VE 22	N/A	Runup	N/A
45	✓	N/A	VE 39-24, AE 24-22	High Velocity Flow	High Velocity Limit
46	✓	VE 22	N/A	PFD	PFD
47	✓	VE 24	N/A	PFD	PFD
48		VE 34	N/A	Runup	N/A
49		N/A	VE 29, VE 24, AE 21	High Velocity Flow	High Velocity Limit
50	✓	VE 20	N/A	Runup	N/A
51	✓	VE 23	N/A	PFD	PFD
52	✓	VE 24	N/A	PFD	PFD
53	✓	VE 22	N/A	PFD	PFD

Table 26: Summary of Coastal Transect Mapping Considerations, con't

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis *Zone Designation and BFE (ft NAVD 88)*	Wave Height Analysis *Zone Designation and BFE (ft NAVD 88)*	Zone VE Limit	SFHA Boundary
54	✓	VE 26	N/A	Runup	N/A
55	✓	N/A	VE 29, VE 22, AE 21	High Velocity Flow	High Velocity Limit
56	✓	N/A	VE 33, VE 23, AE 22	High Velocity Flow	High Velocity Limit
57	✓	VE 22	N/A	Runup	N/A
58	✓	VE 23	N/A	PFD	PFD
59	✓	VE 24	N/A	PFD	PFD
60	✓	VE 21	N/A	PFD	PFD
61	✓	VE 20	N/A	PFD	PFD
62	✓	VE 20	N/A	PFD	PFD
63	✓	VE 20	N/A	PFD	PFD
64	✓	VE 21	N/A	PFD	PFD
65	✓	VE 20	N/A	PFD	PFD
66	✓	VE 19	N/A	PFD	PFD
67	✓	VE 18	N/A	Runup	N/A
68		VE 18, AE 18	N/A	Wave Height	Runup
69		N/A	VE 27, VE 23, AE 21	High Velocity Flow	High Velocity Limit
70	✓	N/A	VE 18	Runup	N/A
71	✓	VE 23	N/A	PFD	PFD
72	✓	VE 22	N/A	PFD	PFD
73	✓	VE 21	N/A	PFD	PFD
74	✓	VE 21	N/A	PFD	PFD
75	✓	VE 21	N/A	PFD	PFD
76	✓	VE 22	N/A	PFD	PFD
77	✓	VE 22	N/A	PFD	PFD
78	✓	VE 21	N/A	PFD	PFD
79	✓	VE 22	N/A	PFD	PFD
80	✓	VE 21	N/A	PFD	PFD
81	✓	VE 22	N/A	PFD	PFD
82	✓	VE 22	N/A	PFD	PFD

Table 26: Summary of Coastal Transect Mapping Considerations, con't

Coastal Transect	Primary Frontal Dune (PFD) Identified	Wave Runup Analysis *Zone Designation and BFE (ft NAVD 88)*	Wave Height Analysis *Zone Designation and BFE (ft NAVD 88)*	Zone VE Limit	SFHA Boundary
83	✓	VE 22	N/A	PFD	PFD
84	✓	VE 24	N/A	PFD	PFD

6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions to FIS projects may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 31, "Map Repositories").

6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA. A LOMA cannot be issued for properties located on the PFD (primary frontal dune).

To obtain an application for a LOMA, visit http://www.fema.gov and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

For more information about how to apply for a LOMA, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting http://www.fema.gov for the "MT-1 Application Forms and

Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Map Information eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at http://www.fema.gov/plan/prevent/fhm/ot_lmreq.shtm.

6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit http://www.fema.gov and download the form "MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision". Visit the "Flood Map-Related Fees" section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Map Information eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the Clatsop County FIRM are listed in Table 27.

Table 27: Incorporated Letters of Map Change

[Not Applicable to this FIS Project]

6.5.4 Physical Map Revisions

PMRs are an official republication of a community's NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community's chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit http://www.fema.gov and visit the "Flood Map Revision Processes" section.

6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified

for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of Clatsop County. Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 28, “Community Map History.” A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or “pending” (for Preliminary FIS Reports) is shown. If the community is listed in Table 28 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first Flood Hazard Boundary Map (FHBM). This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community. This is the first effective date that is shown on the FIRM panel.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as Physical Map Revisions (PMR) of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Clatsop County FIRMs in countywide format was September 17, 2010.

Table 28: Community Map History

Community Name	Initial Identification Date (First NFIP Map Published)	Initial FHBM Effective Date	FHBM Revision Date(s)	Initial FIRM Effective Date	FIRM Revision Date(s)
City of Astoria	06/28/74	06/28/74	04/09/1976	08/01/1978	09/17/2010
City of Cannon Beach	06/21/74	06/21/74	N/A	09/01/1978	09/17/2010
Clatsop County, Unincorporated Areas	12/20/74	12/20/74	N/A	07/03/1978	09/17/2010 06/16/1999
City of Gearhart	12/07/73	12/07/73	12/19/1975	05/15/1978	09/17/2010 06/16/1999 01/03/1983
City of Seaside	12/07/73	12/07/73	04/23/1976	09/05/1979	09/17/2010 10/27/1981
City of Warrenton	06/28/74	06/28/74	10/15/1976	05/15/1978	09/17/2010

SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

7.1 Contracted Studies

Table 29 provides a summary of the contracted studies by flooding source that are included in this FIS Report.

Table 29: Summary of Contracted Studies Included in this FIS Report

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Bear Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Beerman Creek	7/3/1978	West Consultants, Inc.	EMA-2001-CO-0068	June 2007	Clatsop County Uninc. Areas, Seaside
Big Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Cow Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Fishhawk Creek at Birkenfeld	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Fishhawk Creek at Jewell	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas

Table 29: Summary of Contracted Studies Included in this FIS Report, con't

Flooding Source	FIS Report Dated	Contractor	Number	Work Completed Date	Affected Communities
Humbug Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Lewis and Clark River	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Little Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Little Wallooskee River	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977 (Revised – Sept. 1987)	Clatsop County Uninc. Areas
Neacoxie Creek	6/16/1999	USACE – Portland District	EMW-89-E-2994, Project Order No. 9	January 1995 (Revised - June 1999)	City of Gearhart
Neawanna Creek (Lower)	9/17/2010	West Consultants, Inc.	EMA-2001-CO-0068	June 2007	Clatsop County Uninc. Areas, Seaside
Neawanna Creek (Upper)	9/17/2010	West Consultants, Inc.	EMA-2001-CO-0068	June 2007	Clatsop County Uninc. Areas, Seaside
Necanicum River	9/17/2010	West Consultants, Inc.	EMA-2001-CO-0068	June 2007	Clatsop County Uninc. Areas, Seaside
Necanicum River Overflow	9/17/2010	West Consultants, Inc.	EMA-2001-CO-0068	June 2007	Clatsop County Uninc. Areas, Seaside
Nehalem River	9/17/2010	Black & Veatch, Inc.	HSFEHQ-04-D-0025	September 2010	Clatsop County Uninc. Areas
North Fork Nehalem River	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
North Fork Nehalem River at Hamlet	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Northrup Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas
Pacific Ocean	TBD	DOGAMI	EMS-2010-GR-0014	November 2013	Clatsop County Uninc. Areas, Gearhart, Seaside, Cannon Beach
Plympton Creek	7/3/1978	CH2M Hill, Inc.	H-3803	May 1977	Clatsop County Uninc. Areas

7.2 Community Meetings

The dates of the community meetings held for this FIS project and any previous FIS projects are shown in Table 30. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

Table 30: Community Meetings

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Clatsop County and Incorporated Areas	TBD	TBD	Final CCO	TBD
	TBD	12/9/2013	Flood Study Review	DOGAMI, DLCD, FEMA, STARR, Clatsop County, City of Warrenton, City of Cannon Beach, and City of Seaside
	TBD	10/11/2012	Discovery	DOGAMI, DLCD, FEMA, STARR, Clatsop County, City of Astoria, City of Cannon Beach, and City of Warrenton
	TBD	12/9/2013	Stakeholder Coordination	DOGAMI, DLCD, FEMA, STARR, USACE, Clatsop County, and the City of Warrenton
	TBD	4/20/2012	Stakeholder Coordination	DOGAMI, DLCD, FEMA, STARR, USACE, and the City of Warrenton
	TBD	8/26/2011	Stakeholder Coordination	DOGAMI and the City of Warrenton
	TBD	6/13/2011	Stakeholder Coordination	DOGAMI, DLCD, FEMA, Clatsop County, Cities of Astoria, and City of Seaside
Clatsop County, and Incorporated Areas	9/17/2010	11/8/2007	Final CCO	Cities of Astoria, Cannon Beach, Seaside, Warrenton, Clatsop Co., FEMA, Dept. of Land Conservation and Development, and West Consultants
City of Astoria	7/3/1978	September 1975	Initial CCO	FEMA, the community, the state, and the study contractor
	7/3/1978	04/19/1977	Final CCO	FEMA, the community, and the study contractor
City of Cannon Beach	7/3/1978	September 1975	Initial CCO	FEMA, the community, the state, and the study contractor
	7/3/1978	4/18/1977	Final CCO	FEMA, the community, and the study contractor

Table 30: Community Meetings, con't

Community	FIS Report Dated	Date of Meeting	Meeting Type	Attended By
Clatsop County, Unincorporated Areas	7/3/1978	9/4/1975	Initial CCO	FEMA, the community, the state, and the study contractor
	7/3/1978	4/19/1977	Final CCO	FEMA, the community, and the study contractor
City of Gearhart	7/3/1978	September 1975	Initial CCO	FEMA, the community, the state, and the study contractor
	7/3/1978	4/21/1977	Final CCO	FEMA, the community, and the study contractor
City of Seaside	7/3/1978	March 1975	Initial CCO	FEMA, the community, the state, and the study contractor
	7/3/1978	7/13/1978	Final CCO	FEMA, the community, and the study contractor
City of Warrenton	7/3/1978	September 1975	Initial CCO	FEMA, the community, the state, and the study contractor
	7/3/1978	4/19/1977	Final CCO	FEMA, the community, and the study contractor

SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see http://www.fema.gov.

The additional data that was used for this project includes the FIS Report and FIRM that were previously prepared for Clatsop County and Incorporated Areas (FEMA 2010).

Table 31 is a list of the locations where FIRMs for Clatsop County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

Table 31: Map Repositories

Community	Address	City	State	Zip Code
City of Astoria	Community Development, 1095 Duane Street	Astoria	OR	97103
City of Cannon Beach	City Hall, Community Development, 163 East Gower Street	Cannon Beach	OR	97110
Clatsop County, Unincorporated Areas	Community Development, 800 Exchange Street, Suite 100	Astoria	OR	97103
City of Gearhart	City Hall, 698 Pacific Way	Gearhart	OR	97138
City of Seaside	Community Development, 1387 Avenue U	Seaside	OR	97138
City of Warrenton	City Hall, 225 South Main	Warrenton	OR	97146

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 32.

Table 32 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the state NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of state and local GIS data in their state.

Table 32: Additional Information

FEMA and the NFIP	
FEMA and FEMA Engineering Library website	http://www.fema.gov
NFIP website	http://www.fema.gov/business/nfip
NFHL Dataset	http://msc.fema.gov
FEMA Region X	Federal Regional Center, 130 228th Street SW, Bothell, WA 98021-9796 (425) 487-4657
Other Federal Agencies	
USGS website	http://www.usgs.gov
Hydraulic Engineering Center website	http://www.hec.usace.army.mil
State Agencies and Organizations	
State NFIP Coordinator	Christine Shirley Oregon Department of Land Conservation and Development 635 Capitol Street NE, Suite 150 Salem, Oregon 97301 503-934-0027 christine.shirley@state.or.us
State GIS Coordinator	Cy Smith Geospatial Enterprise Office Oregon Department of Administrative Services 155 Cottage Street NE, 4th Floor Salem, Oregon 97301 503-378-6066 cy.smith@state.or.us
State FEMA Cooperating Technical Partner	Jed Roberts Oregon Department of Geology and Mineral Industries 800 NE Oregon Street, Suite 965 Portland, Oregon 97232 971-673-1546 jed.roberts@dogami.state.or.us

SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 33 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

Table 33: Bibliography and References

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Booij et al. 1999	American Geophysical Union	*Journal of Geophysical Research, "A third-generation wave model for coastal regions, part 1: model description and validation," Volume 104, Number C4*	N. Booij, R.C. Ris, and L.H. Holthuijsen	Malden, Massachusetts, USA	April 1999	N/A
Boon 2004	Woodhead Publishing	*"Secrets of the tide: tide and tidal current analysis and applications, storms surges and sea level trends", CRC Marine Science*	J.D. Boon	Cambridge, UK	October 2004	N/A
Cooper 2005	U.S. Geological Survey, U.S. Department of the Interior	*U.S. Geological Survey Scientific Investigations Report 2005-5116, "Estimation of peak discharges for rural, unregulated streams in Western Oregon"*	R.M. Cooper	Washington, DC, USA	2005	N/A
FEMA 2010	U.S. Department of Homeland Security, Federal Emergency Management Agency	*"Flood insurance study for Clatsop County, Oregon an incorporated areas," Volume 1*	Federal Emergency Management Agency	Washington, DC, USA	September 17, 2010	http://msc.fema.gov

Table 33: Bibliography and References, con't

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
Kriebal and Dean 1993	American Society of Civil Engineers	*Journal of Waterway, Port, Coastal, and Ocean Engineering, "Convolution method for time-dependent beach-profile response," Volume 119, Issue 2*	D.L. Kriebel and R.G. Dean	Reston, Virginia, USA	March 1993	N/A
Ris et al. 1999	American Geophysical Union	*Journal of Geophysical Research, "A third-generation wave model for coastal regions, part 2: verification," Volume 104, Number C4*	R.C. Ris, L.H. Holthuijsen, N. Booij	Malden, Massachusetts, USA	April 1999	N/A
Stockdon et al. 2006	World Scientific	*Coastal Engineering, "Empirical parameterization of setup, swash, and runup," Volume 53, Issue 7*	H.F. Stockdon, R.A. Holman, P.A. Howd, and A.H. Sellenger Jr.	Hackensack, New Jersey, USA	May 2006	N/A
van der Meer 2002	Technical Advisory Committee on Flood Defense, The Netherlands	*"Technical report: wave run-up and overtopping at dikes"*	J.W. van der Meer	Delft, Netherlands	May 2002	N/A
WRC 1981	U.S. Department of the Interior	*"Guidelines for Determining Flood Flow Frequencies," Bulletin #17B*	Water Resources Council, Hydrology Committee	Washington, DC, USA	September 1981	N/A

Table 33: Bibliography and References, con't

Citation in this FIS	Publisher/ Issuer	*Publication Title,* "Article," Volume, Number, etc.	Author/Editor	Place of Publication	Publication Date/ Date of Issuance	Link
USACE 2010	U.S. Army Corps of Engineers	*"HEC-RAS Version 4.1.0"*	Hydrologic Engineering Center	Davis, California, USA	January 2010	N/A