

Port of Astoria Presentation To:  
HOUSE COMMITTEE ON VETERANS AND  
EMERGENCY PREPAREDNESS

April 25, 2019

Jim Knight  
Executive Director



# 9.0 Cascadia Subduction Zone Event

+/- 20-40 Minutes



☆ Escarpments

~ Scarp

☆ Flanks

Deep

Shallow

☆ DOGAMI Landslides

Landslide Complex

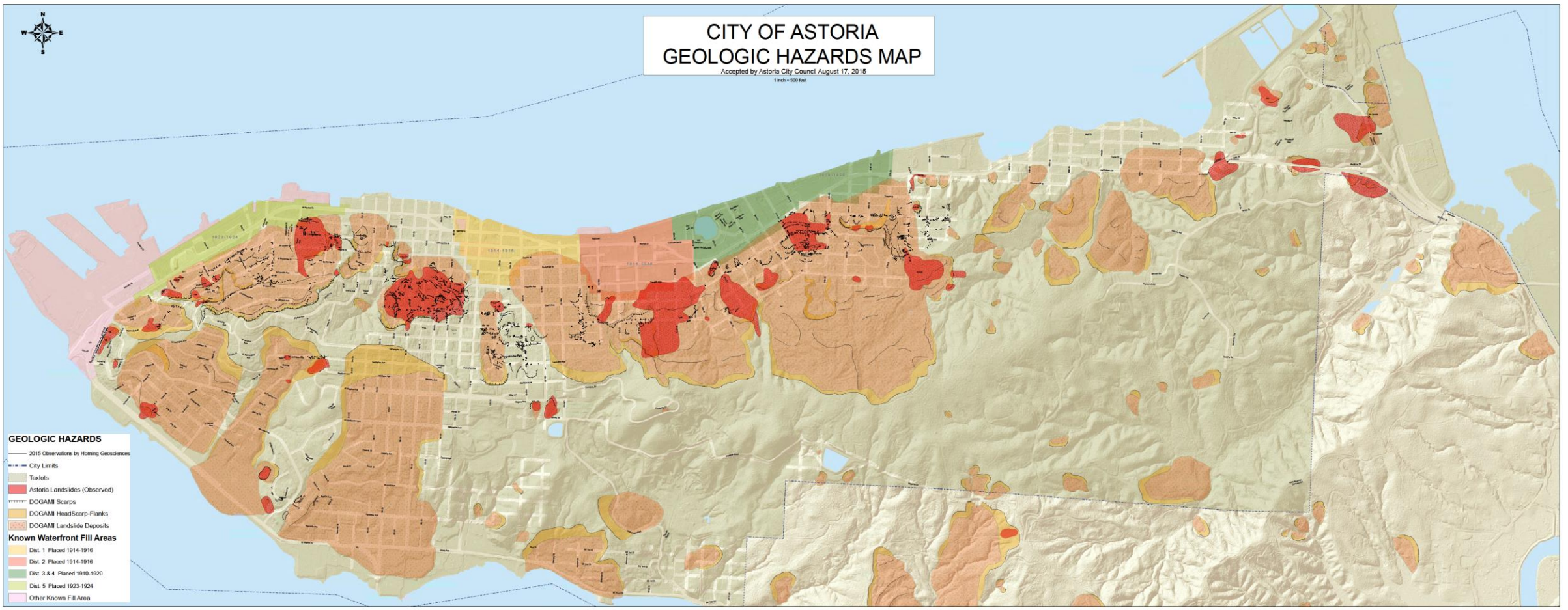
Flow

Slide



# CITY OF ASTORIA GEOLOGIC HAZARDS MAP

Accepted by Astoria City Council August 17, 2015  
1 inch = 500 feet



- GEOLOGIC HAZARDS**
- 2015 Observations by Horning Geosciences
  - - - City Limits
  - Taxlots
  - Astoria Landslides (Observed)
  - DOGAMI Scarps
  - DOGAMI HeadScarp-Flanks
  - DOGAMI Landslide Deposits
- Known Waterfront Fill Areas**
- Dist. 1 Placed 1914-1916
  - Dist. 2 Placed 1914-1916
  - Dist. 3 & 4 Placed 1910-1920
  - Dist. 5 Placed 1923-1924
  - Other Known Fill Area

# Local Source (Cascadia Subduction Zone) Tsunami Inundation Map Astoria, Oregon

Tsunami Inundation Map Clat-04  
Tsunami Inundation Map for Astoria, Oregon  
Date: 11/10/2013  
Page 1 of 1



### Introduction

The Oregon Department of Geology and Mineral Industries (DOGAMI) has been studying and mapping the coastal inundation hazard along the Oregon coast since 1984. The Oregon Tsunami Inundation Hazard (OTIH) program was created in 2007 to provide a consistent and comprehensive approach to the National Hazard Mitigation Program. The OTIH program was created to provide a consistent and comprehensive approach to the National Hazard Mitigation Program. The OTIH program was created to provide a consistent and comprehensive approach to the National Hazard Mitigation Program.

### Map Explanation

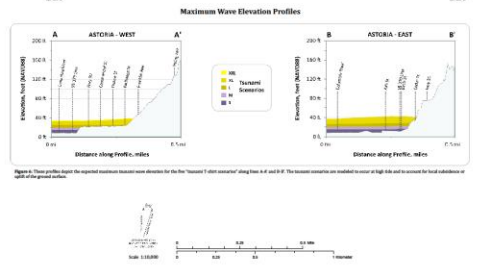
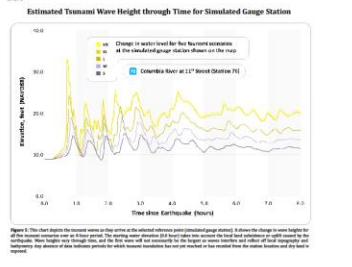
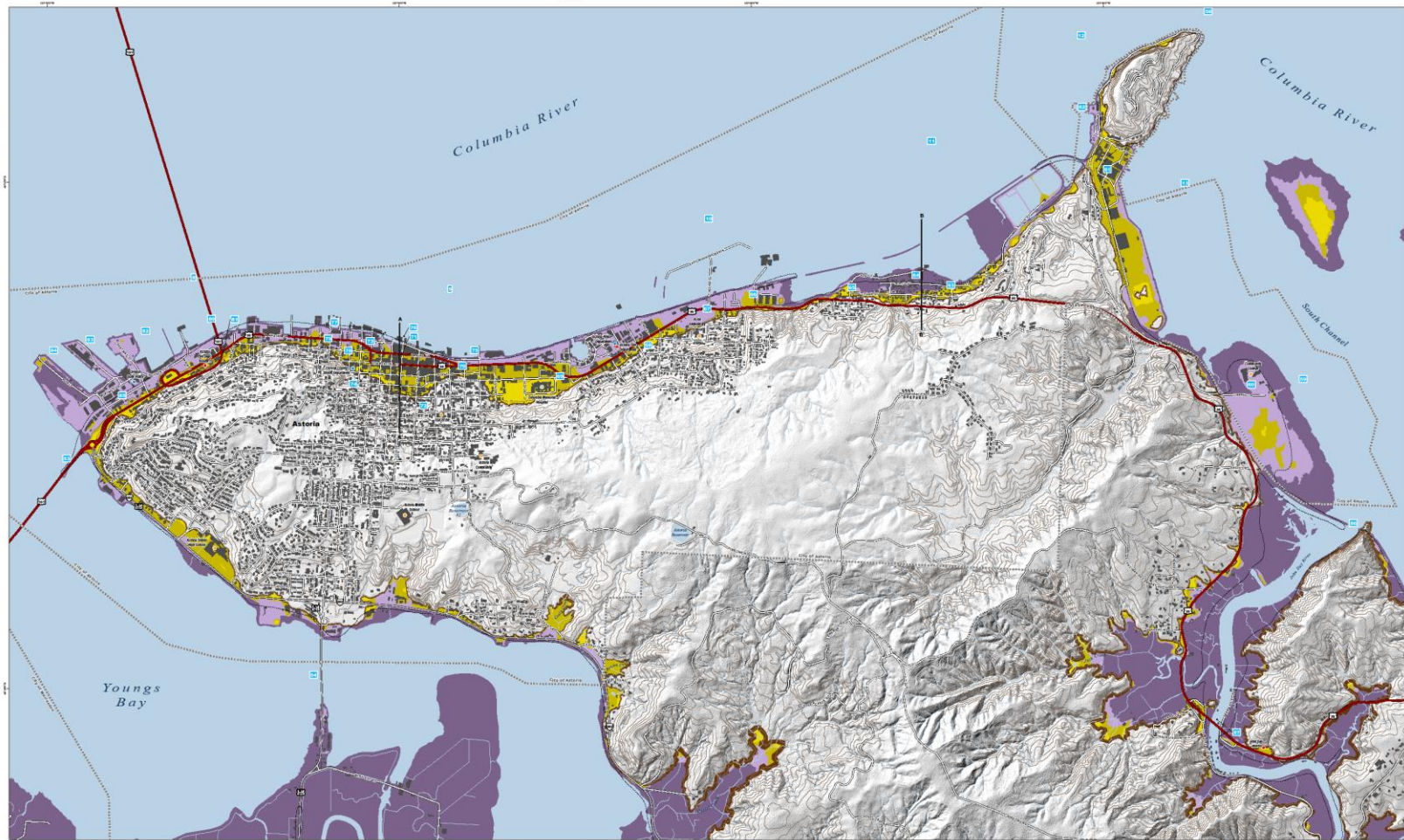
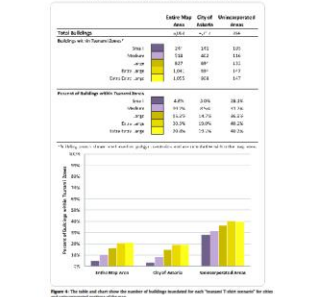
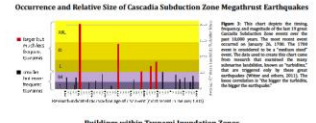
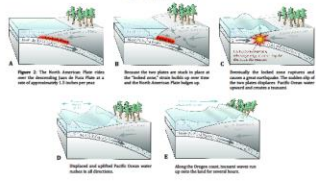
The inundation hazard map displays the range of inundation depths for the worst case scenario. The map is based on the best available data and is intended to provide a general overview of the hazard. The map is based on the best available data and is intended to provide a general overview of the hazard.

The Oregon Tsunami Inundation Hazard (OTIH) program was created in 2007 to provide a consistent and comprehensive approach to the National Hazard Mitigation Program. The OTIH program was created to provide a consistent and comprehensive approach to the National Hazard Mitigation Program.

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Figure 1: The block diagram depicts the oceanic setting of the region. The map is for the region of the Cascadia Subduction Zone.



**Legend**

Earthquake Size	Average Slip Range (cm)	Maximum Slip Range (cm)	Time to Accessible Slip (hrs)	Earthquake Magnitude
M6.0	50 to 70	100 to 140	1,200	-9.1
M6.5	70 to 90	140 to 200	1,000 to 1,500	-9.6
M7.0	100 to 150	200 to 300	1,000 to 2,000	-10.1
M7.5	150 to 200	300 to 450	1,000 to 2,000	-10.6
M8.0	200 to 300	450 to 700	1,000 to 2,000	-11.1
M8.5	300 to 450	700 to 1,000	1,000 to 2,000	-11.6
M9.0	450 to 700	1,000 to 1,500	1,000 to 2,000	-12.1
M9.5	700 to 1,000	1,500 to 2,000	1,000 to 2,000	-12.6

**Tsunami Inundation Map Index**

**Data References**

DOGAMI, Oregon Department of Geology and Mineral Industries. Oregon Tsunami Inundation Hazard (OTIH) Program. Astoria, Oregon. 2013.

U.S. Geological Survey. National Earthquake Information Center. Earthquake Catalogue of the United States, 1900 to Present. 2013.



# Local Source (Cascadia Subduction Zone) Tsunami Inundation Map Warrenton North, Oregon

**Introduction**

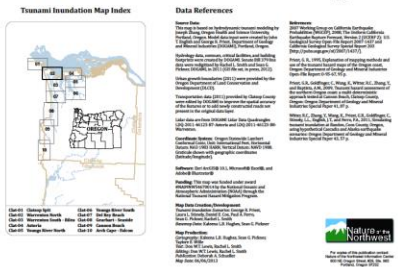
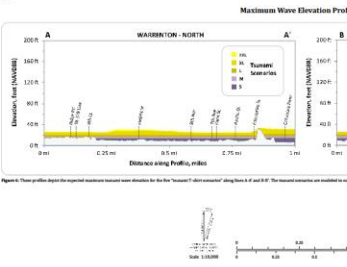
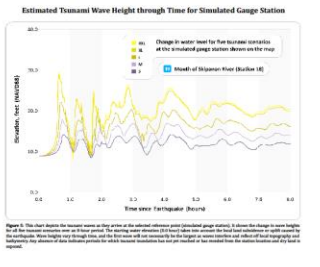
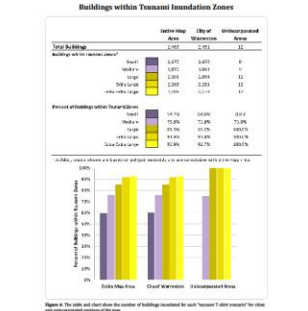
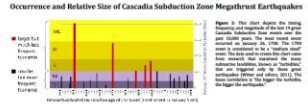
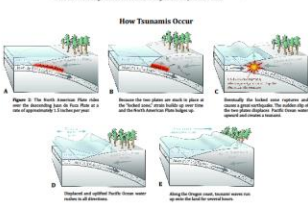
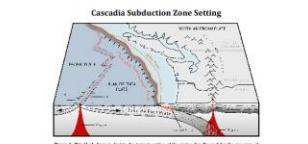
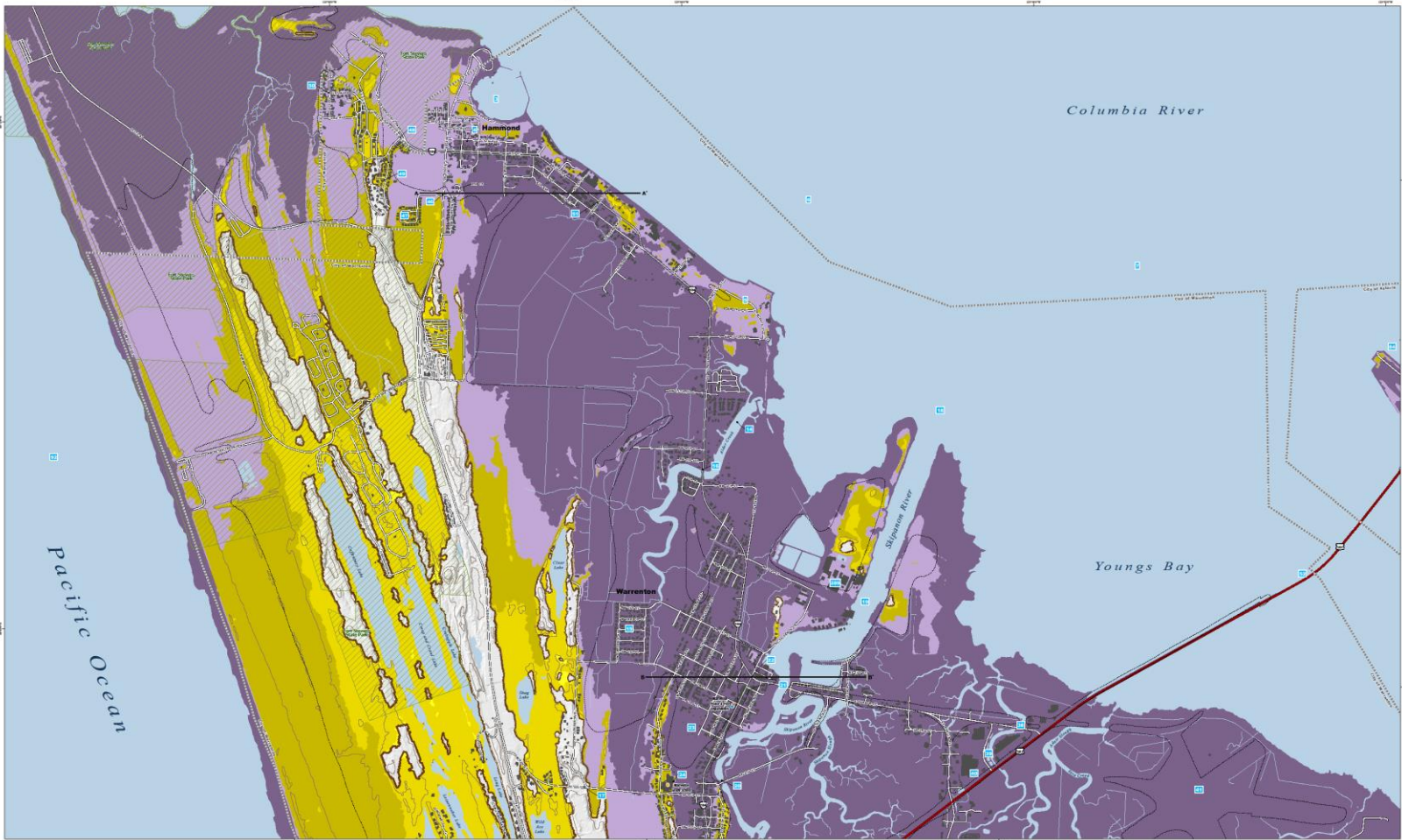
The Oregon Department of Geology and Mineral Industries (ODGI) has been developing and updating the tsunami inundation hazard along the Oregon coast since 1994. ODGI's 2004 update to the National Tsunami Hazard Mitigation Program, which has been authorized by the National Oceanic and Atmospheric Administration (NOAA) since 1995, ODGI's work is ongoing to update the coastal tsunami inundation hazard along the Oregon coast and other areas to include the potential for Cascadia Subduction Zone (CSZ) megathrust earthquakes and tsunamis. The project is a continuation of the work that was completed in 2004 and 2005. The project is a continuation of the work that was completed in 2004 and 2005. The project is a continuation of the work that was completed in 2004 and 2005.

**Map Explanation**

This tsunami inundation map displays the output of computer models simulating the potential tsunami inundation hazard along the Oregon coast. The map shows the potential tsunami inundation hazard along the Oregon coast. The map shows the potential tsunami inundation hazard along the Oregon coast. The map shows the potential tsunami inundation hazard along the Oregon coast.

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**Data References**

This section lists the data sources used in the map. The section lists the data sources used in the map. The section lists the data sources used in the map.



# Local Source (Cascadia Subduction Zone) Tsunami Inundation Map Warrenton South - Rilea, Oregon

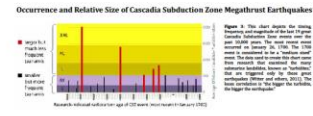
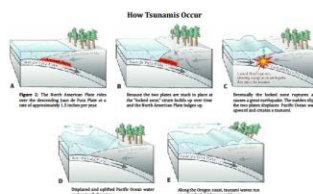
### Introduction

The Oregon Department of Geology and Mineral Industries (ODGI) has been studying and mapping the Cascadia Subduction Zone (CSZ) along the Oregon coast since 1996. In Oregon, ODGI manages the National Natural Hazard Mitigation Program (NHMP) and is authorized by the National Oceanic and Atmospheric Administration (NOAA) under 50 USC 50420 to conduct hazard mitigation studies and other work in coastal areas where the potential for disaster is assessed. ODGI is currently conducting a study of the potential for disaster in coastal areas where the potential for disaster is assessed. ODGI is currently conducting a study of the potential for disaster in coastal areas where the potential for disaster is assessed.

ODGI has also incorporated geologic evidence that suggests that portions of the coast may be at risk for being overtopped. This effect is known as subsidence. Detailed information on bathymetry, geologic evidence, and other information is available in the National Oceanic and Atmospheric Administration (NOAA) under 50 USC 50420 to conduct hazard mitigation studies and other work in coastal areas where the potential for disaster is assessed. ODGI is currently conducting a study of the potential for disaster in coastal areas where the potential for disaster is assessed.

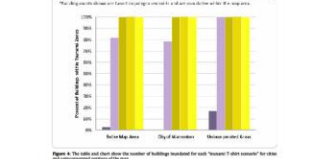
The CSZ is the tectonic plate boundary between the North American Plate and the Juan de Fuca Plate. These plates are converging at a rate of about 1.5 inches per year, but the movement is not smooth and constant. Instead, the plates are locked together through the Cascadia Subduction Zone (CSZ). The plates are locked together through the Cascadia Subduction Zone (CSZ). The plates are locked together through the Cascadia Subduction Zone (CSZ).

CSZ History: Comprehensive research of the offshore geologic record indicates that the CSZ has been active for at least 10,000 years. The CSZ has been active for at least 10,000 years. The CSZ has been active for at least 10,000 years. The CSZ has been active for at least 10,000 years.



### Buildings within Tsunami Inundation Zones

Total # of Buildings	Uninhabited	City of Warrenton	City of Rilea	City of Sunset Beach
1,000	100	200	300	400
2,000	200	400	600	800
3,000	300	600	900	1,200
4,000	400	800	1,200	1,600
5,000	500	1,000	1,500	2,000
6,000	600	1,200	1,800	2,400
7,000	700	1,400	2,100	2,800
8,000	800	1,600	2,400	3,200
9,000	900	1,800	2,700	3,600
10,000	1,000	2,000	3,000	4,000



### Map Explanation

The tsunami inundation map displays the impact of tsunami waves inundating the coastal region. The map shows the extent of inundation for different tsunami scenarios. The map shows the extent of inundation for different tsunami scenarios. The map shows the extent of inundation for different tsunami scenarios.

The computer simulation model output is provided to illustrate the extent of inundation. The computer simulation model output is provided to illustrate the extent of inundation. The computer simulation model output is provided to illustrate the extent of inundation.

This map also shows the regulatory tsunami inundation for Oregon. This map also shows the regulatory tsunami inundation for Oregon. This map also shows the regulatory tsunami inundation for Oregon.

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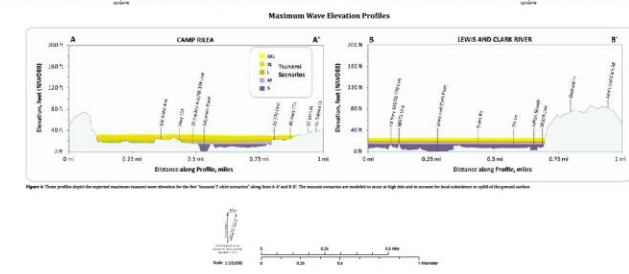
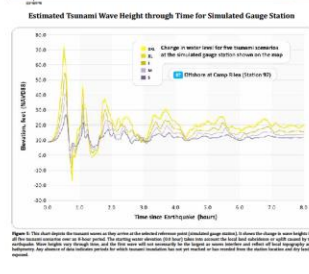
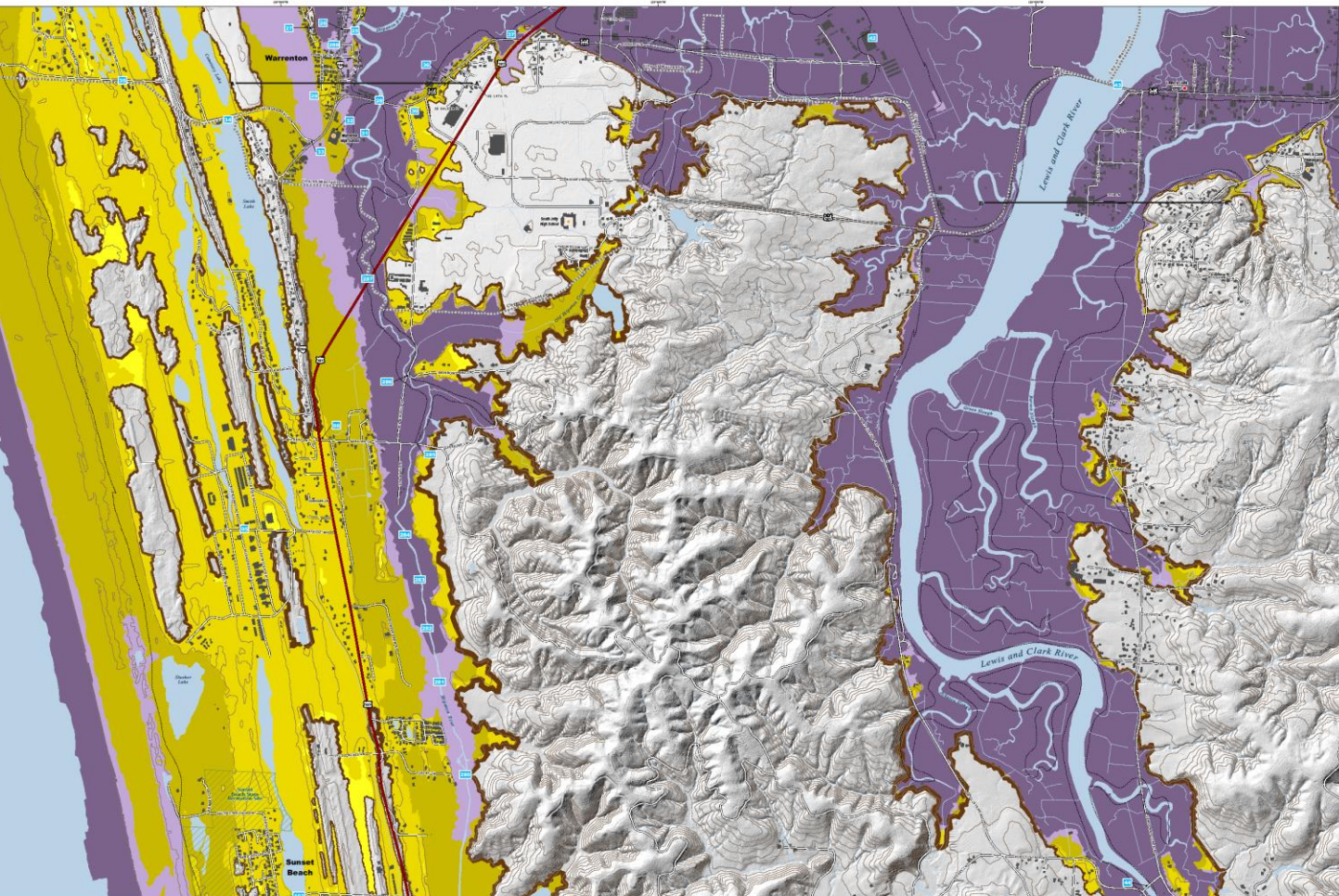
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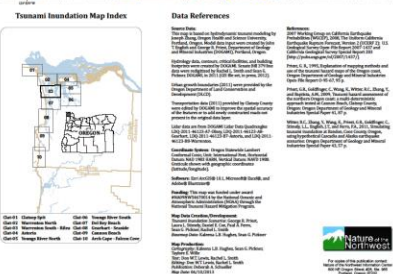
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### Legend

Earthquake Size	Average Slip Range (ft)	Maximum Slip Range (ft)	Time to Arrive at Warrenton (hr)	Earthquake Magnitude
MSL	50 to 72	118 to 144	1,200	-6.1
M	50 to 72	115 to 144	1,050 to 1,200	-6.5
L	36 to 49	72 to 96	650 to 800	-6.9
M	23 to 36	46 to 62	425 to 525	-6.9
S	13 to 16	36 to 36	300	-6.7



### Data References

U.S. Geological Survey, National Earthquake Information Center, 2002. <http://www.seis.gov/>

U.S. Geological Survey, National Earthquake Information Center, 2002. <http://www.seis.gov/>

U.S. Geological Survey, National Earthquake Information Center, 2002. <http://www.seis.gov/>

# Local Source (Cascadia Subduction Zone) Tsunami Inundation Map Del Rey Beach, Oregon

2013

### Introduction

The Oregon Department of Geology and Mineral Industries (DOGMI) has been identified as a leading agency in the state for tsunami hazard assessment. The Oregon Department of Geology and Mineral Industries (DOGMI) has been identified as a leading agency in the state for tsunami hazard assessment. The Oregon Department of Geology and Mineral Industries (DOGMI) has been identified as a leading agency in the state for tsunami hazard assessment.

DOGMI has also incorporated physical evidence that suggests that tsunamis have occurred in the past. The Oregon Department of Geology and Mineral Industries (DOGMI) has been identified as a leading agency in the state for tsunami hazard assessment. The Oregon Department of Geology and Mineral Industries (DOGMI) has been identified as a leading agency in the state for tsunami hazard assessment.

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### Map Explanation

This inundation map displays the extent of computer models representing the selected tsunami scenario. All of which include the geologic and bathymetric data and the terrain and bathymetry of the Del Rey Beach. Each scenario assumes that a tsunami occurs at the Del Rey Beach. The Oregon Department of Geology and Mineral Industries (DOGMI) has been identified as a leading agency in the state for tsunami hazard assessment.

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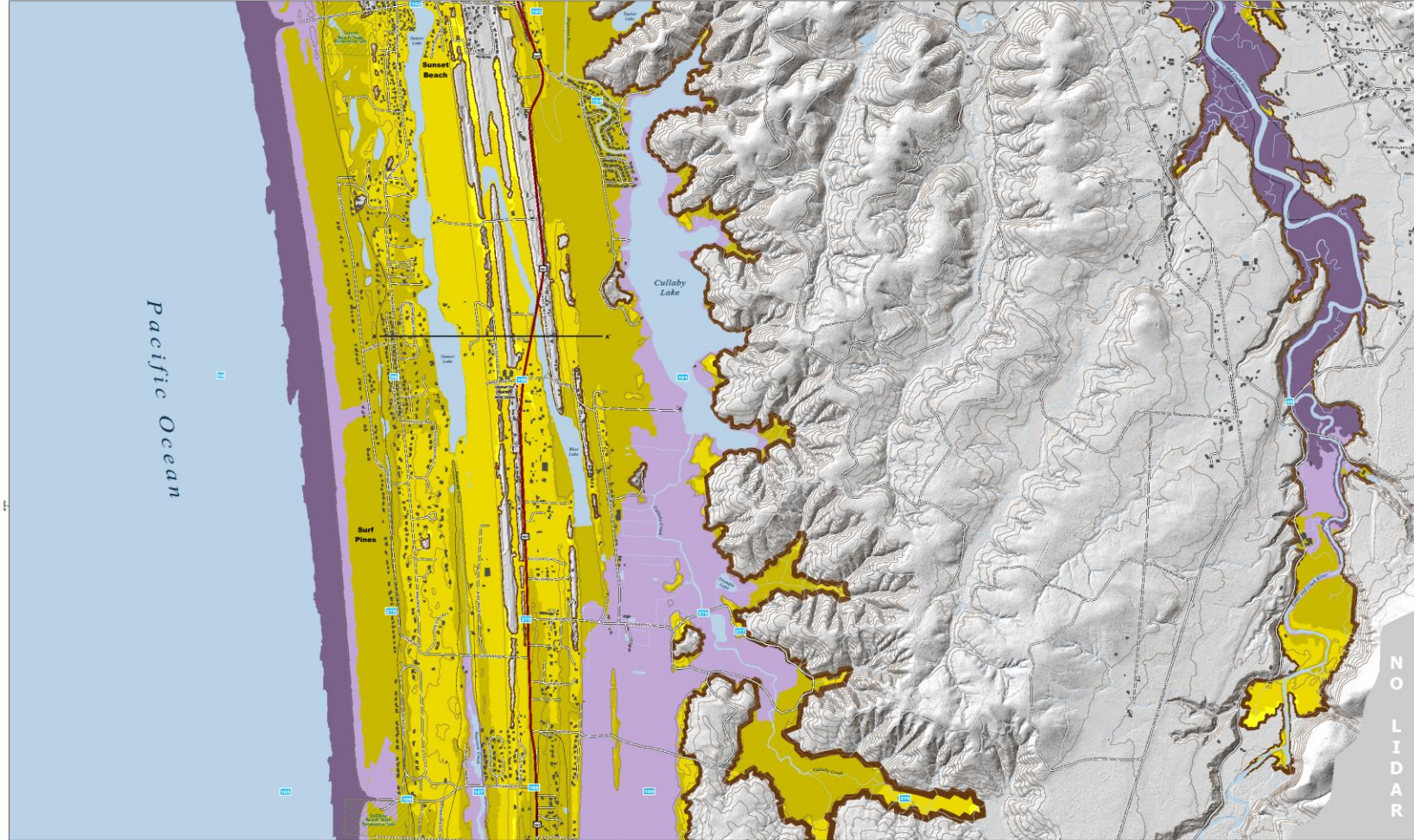
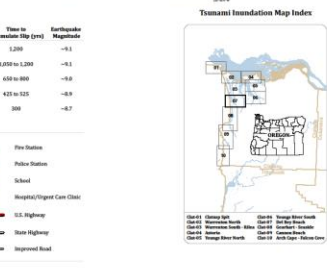
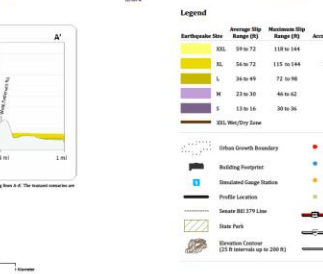
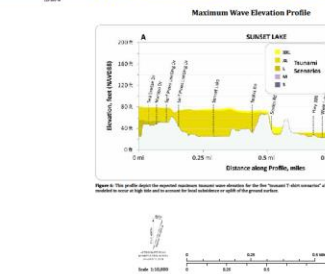
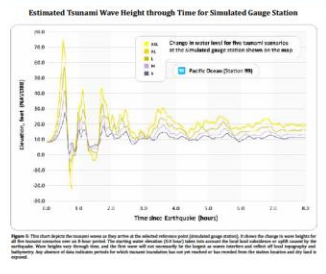
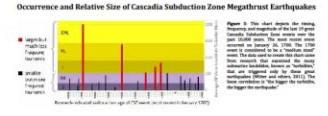
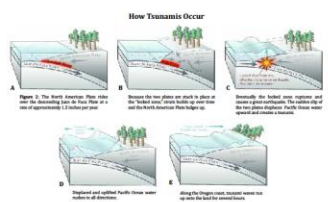
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N O L I D A R





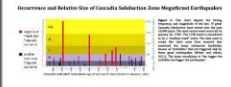
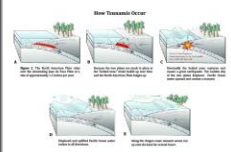
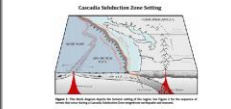
**Introduction**  
 The Oregon Department of Geology and Mineral Industries (DOGDI) has been instrumental in the development of the Oregon Department of Transportation's (ODOT) Oregon Coastal Hazard Mitigation Study. This study is a component of the Oregon Coastal Hazard Mitigation Study, which is a multi-agency effort to identify and assess coastal hazards and develop strategies to reduce their impacts. The purpose of this map is to provide information on the potential impacts of a local source tsunami on the coastal communities of Gearhart and Seaside, Oregon.

**Map Explanation**  
 This map illustrates the potential inundation areas resulting from a local source tsunami. The inundation areas are shown in yellow, orange, and red, representing different levels of inundation depth. The map also shows the Pacific Ocean coastline, major roads, and local landmarks.

**Map Scale**  
 The map scale is 1:25,000.

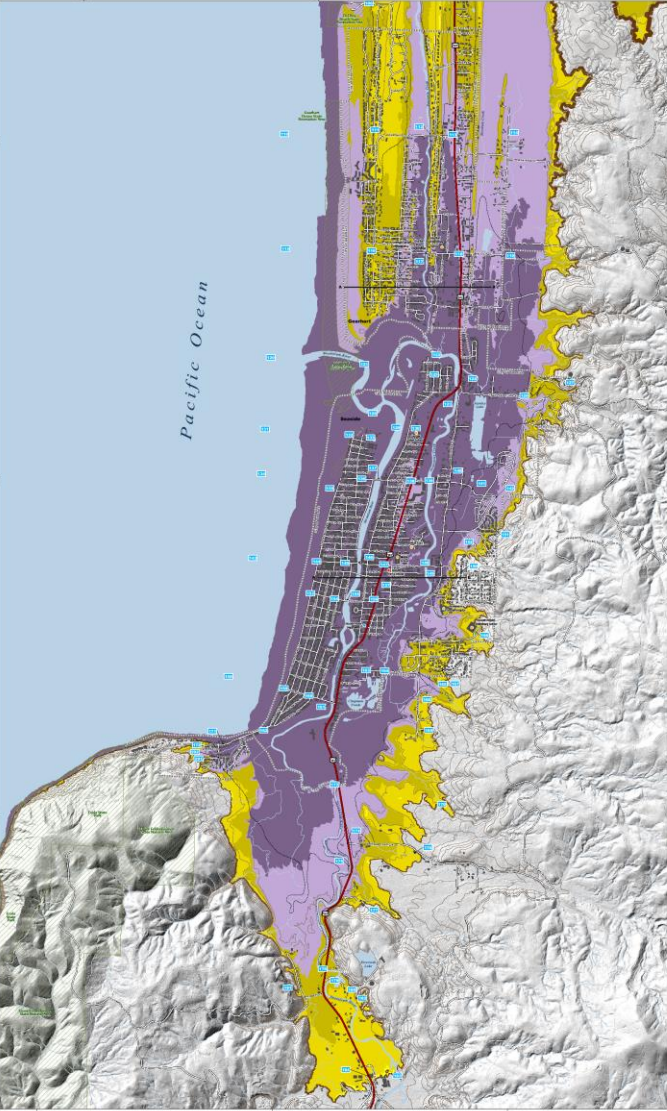
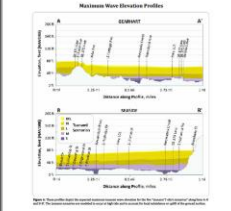
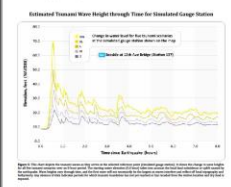
**Map Projection**  
 The map projection is NAD 83 UTM Zone 18N.

**Data Sources**  
 The data for this map was derived from the Oregon Coastal Hazard Mitigation Study, which utilized data from the Oregon Department of Geology and Mineral Industries, the Oregon Department of Transportation, and the Oregon Department of Land Conservation and Development.



**Buildings within Tsunami Inundation Zones**

Inundation Depth (ft)	Buildings	Value
0 to 1	Buildings	1,234,567
1 to 2	Buildings	2,345,678
2 to 3	Buildings	3,456,789
3 to 4	Buildings	4,567,890
4 to 5	Buildings	5,678,901
5 to 6	Buildings	6,789,012
6 to 7	Buildings	7,890,123
7 to 8	Buildings	8,901,234
8 to 9	Buildings	9,012,345
9 to 10	Buildings	10,123,456



**Legend**

Symbol/Color	Description
Yellow	0 to 1 ft Inundation Depth
Orange	1 to 2 ft Inundation Depth
Red	2 to 3 ft Inundation Depth
Blue	Water
Black	Major Road
Grey	Minor Road
Green	Vegetation
Blue	Public Harbor
Red	Seaside Airport
Blue	Seaside Harbor



**Data References**  
 Oregon Department of Geology and Mineral Industries (DOGDI)  
 Oregon Department of Transportation (ODOT)  
 Oregon Department of Land Conservation and Development (DLCD)  
 United States Geological Survey (USGS)  
 National Oceanic and Atmospheric Administration (NOAA)

**Introduction**

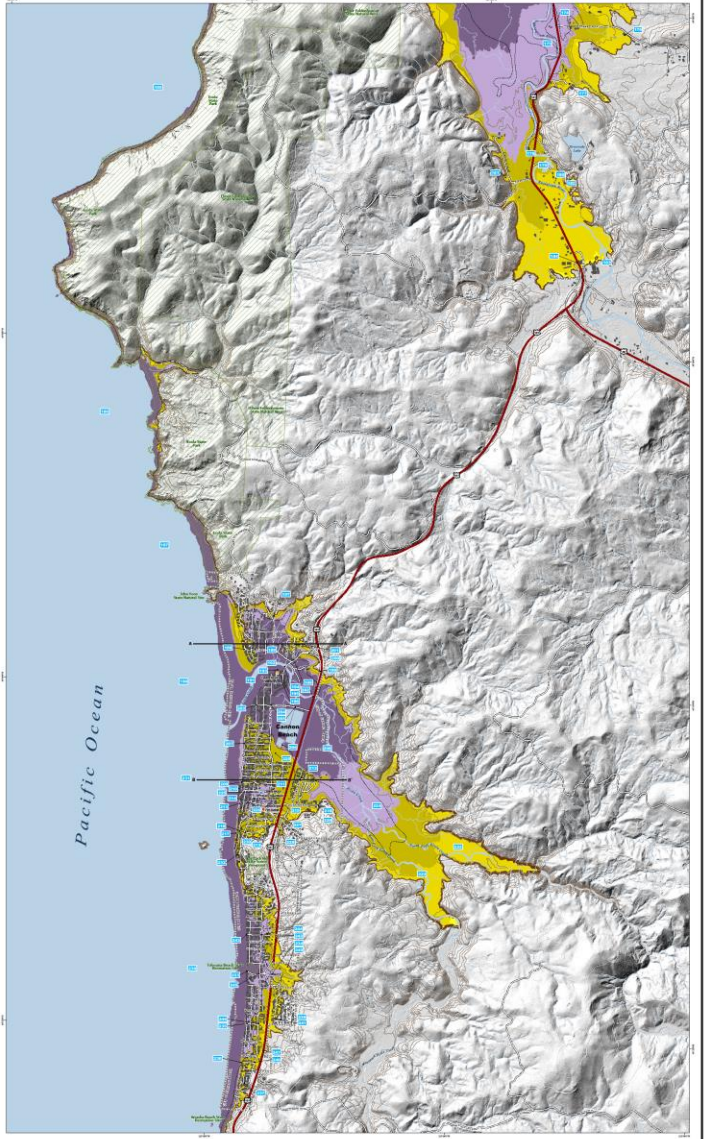
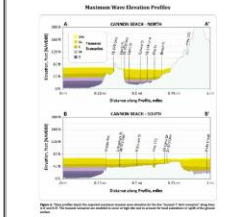
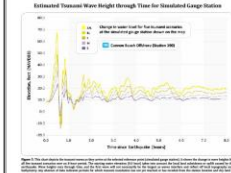
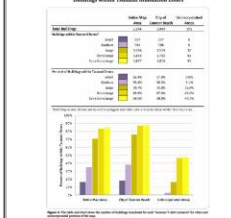
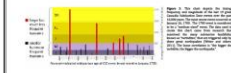
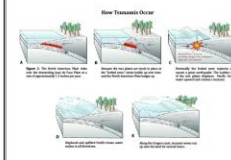
The purpose of this map is to provide information on the potential tsunami inundation hazard from a local source (Cascadia Subduction Zone) tsunami at Cannon Beach, Oregon. This map is intended to be used in conjunction with the local tsunami evacuation routes map and the local tsunami inundation hazard map. The information provided on this map is for informational purposes only and is not intended to be used as a basis for any legal or financial decisions.

**Map Explanations**

The map shows the potential tsunami inundation hazard from a local source (Cascadia Subduction Zone) tsunami at Cannon Beach, Oregon. The map is based on the local tsunami inundation hazard map and the local tsunami evacuation routes map. The map shows the potential tsunami inundation hazard from a local source (Cascadia Subduction Zone) tsunami at Cannon Beach, Oregon. The map is based on the local tsunami inundation hazard map and the local tsunami evacuation routes map.

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**Legend**

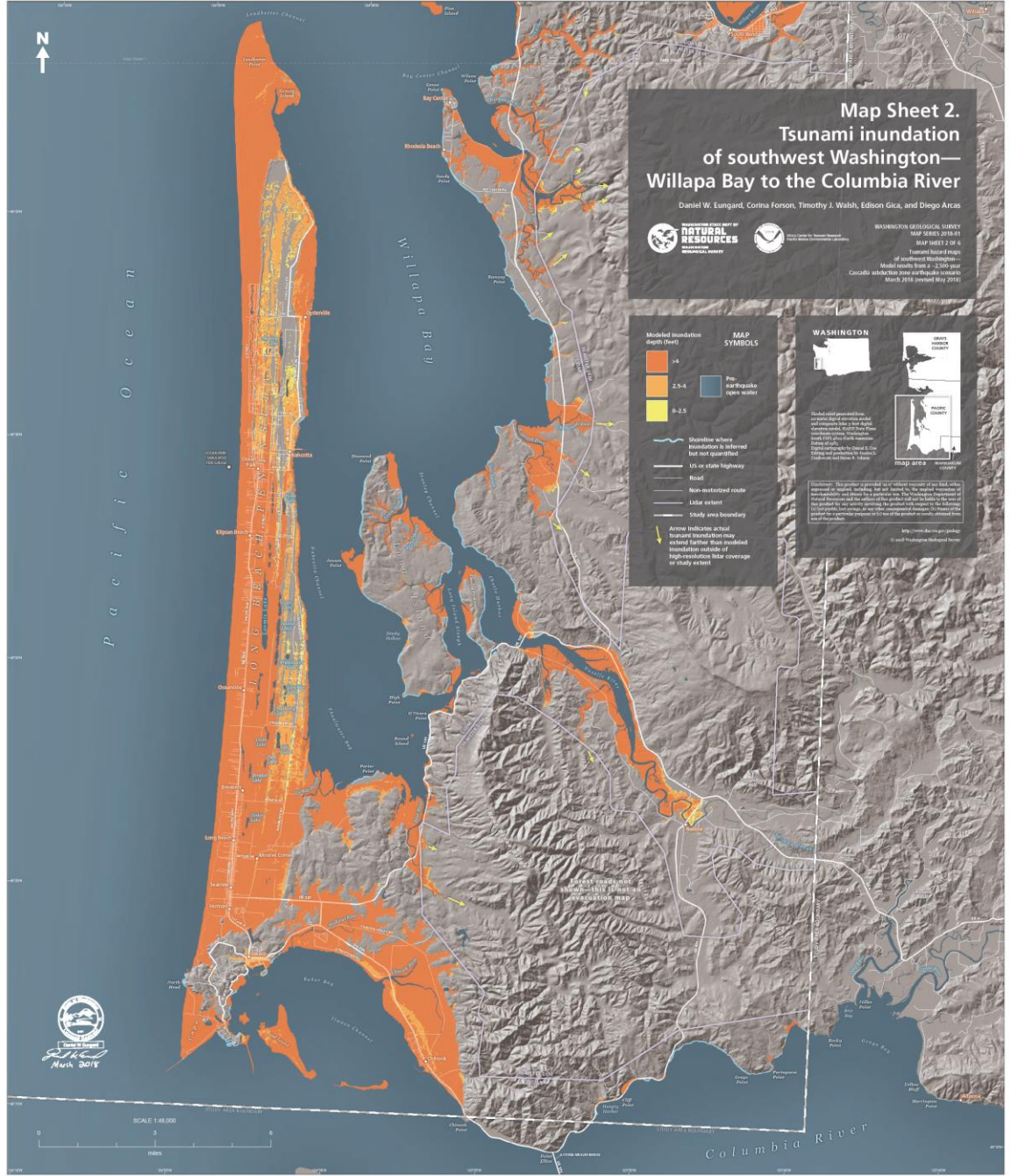
- 0-10 ft
- 10-20 ft
- 20-30 ft
- 30-40 ft
- 40-50 ft
- 50-60 ft
- 60-70 ft
- 70-80 ft
- 80-90 ft
- 90-100 ft

**Tsunami Inundation Map Index**

This index map shows the location of Cannon Beach, Oregon, within the larger context of the Pacific Northwest coast. It includes a scale bar and a north arrow.

**Notes**

This map is based on the local tsunami inundation hazard map and the local tsunami evacuation routes map. The map shows the potential tsunami inundation hazard from a local source (Cascadia Subduction Zone) tsunami at Cannon Beach, Oregon. The map is based on the local tsunami inundation hazard map and the local tsunami evacuation routes map.



# Map Sheet 2. Tsunami inundation— Willapa Bay to the Columbia River

Daniel W. Lungard, Corina Forson, Timothy J. Walsh, Edson Gica, and Diego Arcas

WASHINGTON STATE DEPT OF NATURAL RESOURCES  
 WASHINGTON GEOLOGICAL SURVEY  
 MAP SHEET 2 OF 6  
 Tsunami hazard maps of southwest Washington—Model results from 2000 year Cascadia subduction zone earthquake scenario (March 2010 revised May 2011)

**Modelled inundation depth (feet)**

- 4-6
- 2.5-4
- 0-2.5

**MAP SYMBOLS**

- Shoreline where inundation is inferred but not quantified
- US or state highway
- Road
- Non-motorized route
- Listed extent
- Study area boundary
- Arrow indicates actual tsunami inundation may extend farther than provided. Inundation outside of high-resolution base coverage of study extent.

**WASHINGTON**

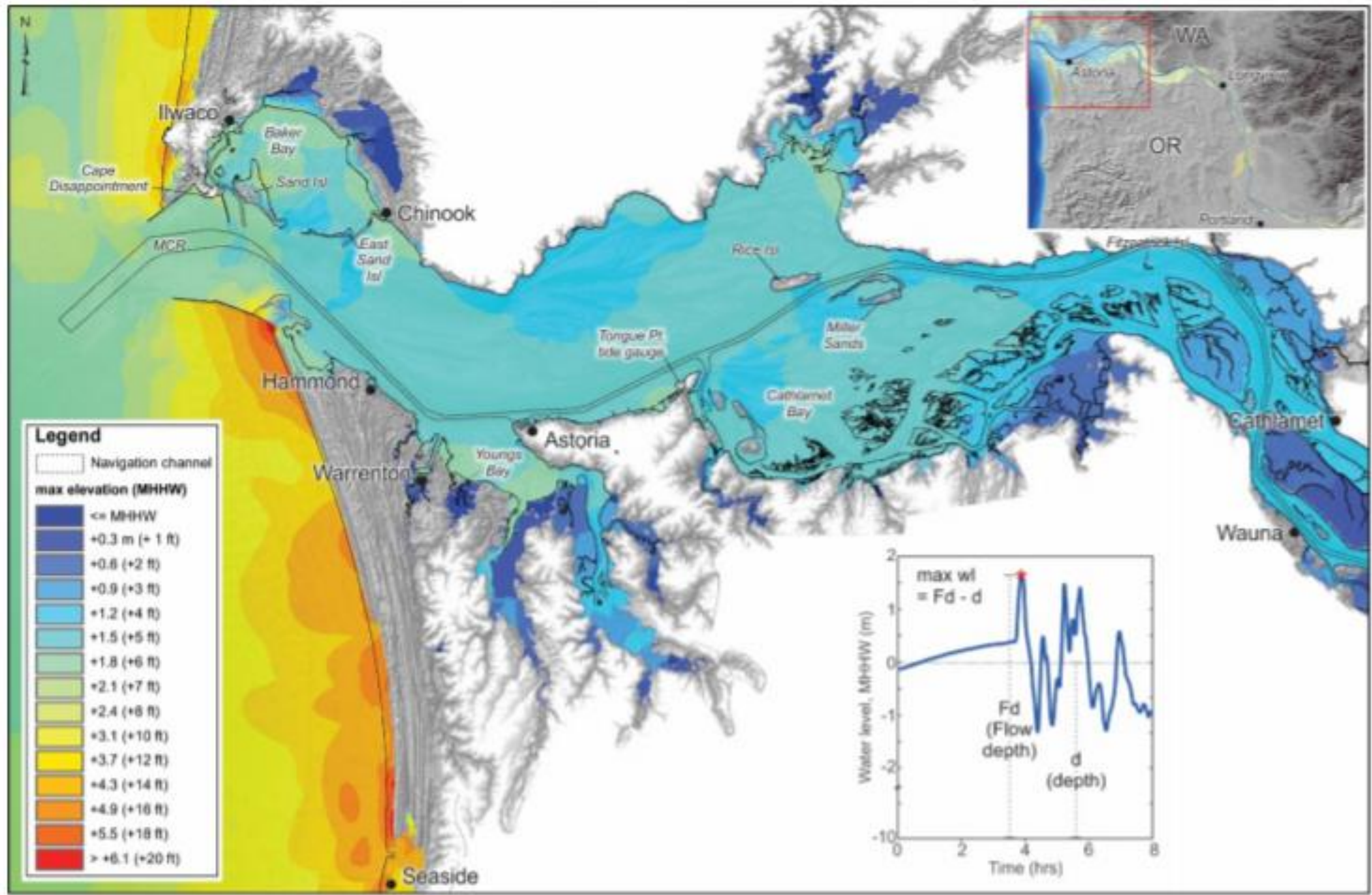
**map area**

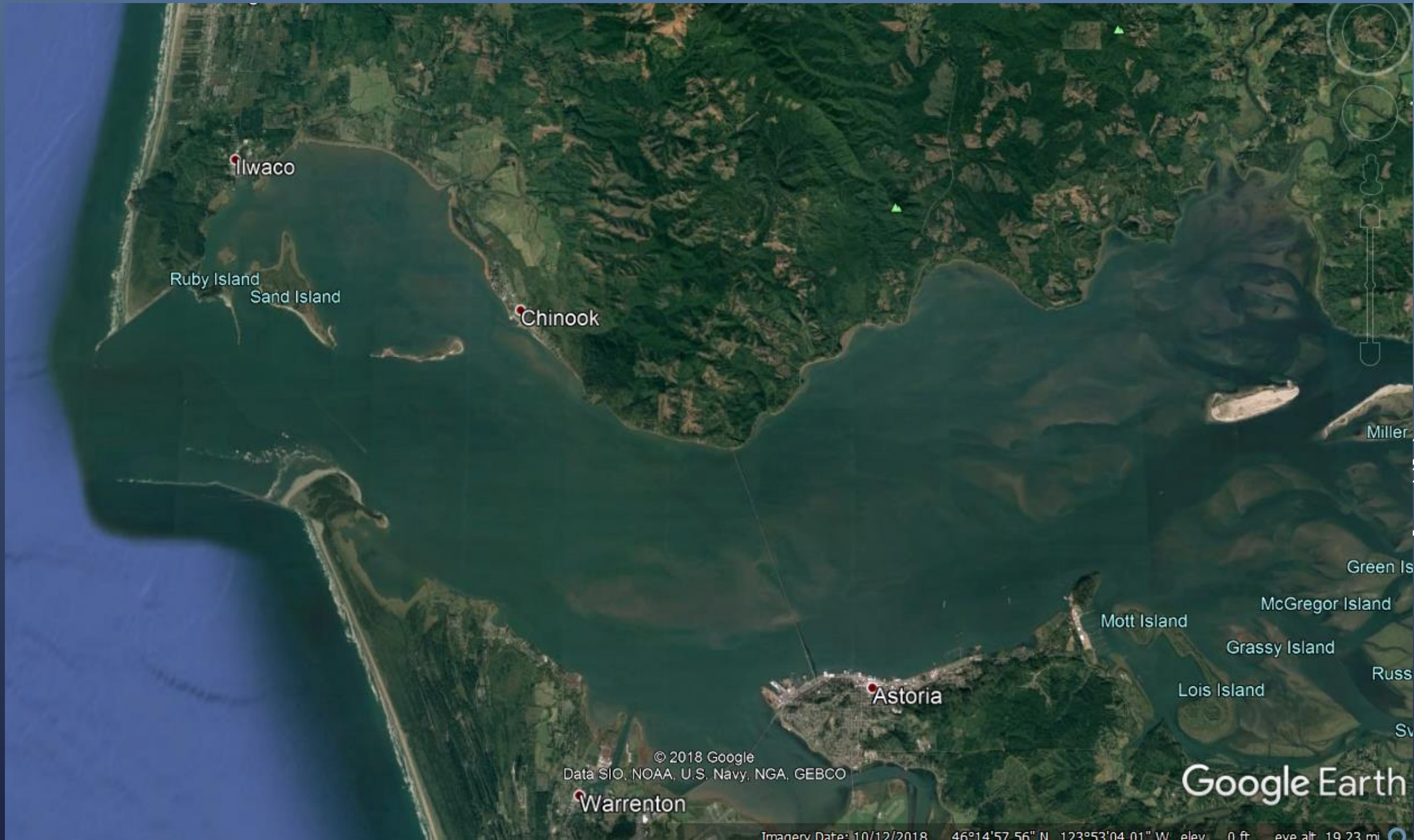
**Disclaimer:** This product is provided as a general overview of the risk, which is based on model results. It is not intended to be used for the purpose of engineering or other design. The Washington Department of Natural Resources is not responsible for any use of this product for purposes other than those intended. The Department of Natural Resources is not responsible for any use of this product for purposes other than those intended. The Department of Natural Resources is not responsible for any use of this product for purposes other than those intended.



SCALE 1:40,000  
 0 1 2 3 4 5  
 MILES







Ilwaco

Ruby Island  
Sand Island

Chinook

Miller

Green Is

McGregor Island

Mott Island

Grassy Island

Russ

Lois Island

Sv

Astoria

Warrenton

Google Earth

© 2018 Google  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO


Imagery Date: 10/12/2018 46°14'57.56" N 123°53'04.01" W elev. 0 ft eye alt. 19.23 mi

# Considerations and Implications

## Time of Event:

- Year
  - Weather
  - Tide
  - Number of Vessels in Port and at Anchor
- 
- A decorative graphic consisting of several parallel white lines of varying lengths, slanted upwards from left to right, located in the bottom right corner of the slide.

# Probable Challenges

- Massive Casualties
  - Loss of Roads/Bridges/Rail
  - Multiple “Islands” of Survivors
  - Loss of Medical Facilities
  - Limited Access (if any) to Communications
  - Supplies: Food/Water/Shelter/Medicine
  - Catastrophic Failure of ALL Infrastructure
  - Emergency Response
- 

Current Resources

Massively  
Inadequate

Planning Efforts

We are in our  
Infancy





Thank You For This Opportunity

Jim Knight  
Executive Director  
Port of Astoria

