



# Flood



## Hazard Description

Flooding is a naturally occurring cycle. It occurs when the volume of precipitation (rain or snow) exceeds the capacity of river banks to keep flowing waters contained. Of all natural hazards that affect Grays Harbor County, floods are one of the most common and, on an annual average basis, the most costly. Grays Harbor County has received 12 Federal Disaster Declarations for flood since 1962, with most floods of the declaration-level events occurring in December and February.

### Several factors determine the severity of floods:

- Precipitation, intensity, and duration;
- Soil saturation conditions;
- Topography and ground cover;
- Amount of snow.

Estimated Probability of Flood Event		
EVENT	ANNUAL CHANCE OF OCCURRENCE	
10-year flood	10%	
25-year flood	4%	
50-year flood	2%	
100-year flood	1%	
500-year flood	0.2%	

Table 1 – Estimated Probability

### National Flood Insurance

Congress established the National Flood Insurance Program (NFIP) in 1968. This federal program enables property owners in participating communities to purchase insurance to protect against flood losses in exchange for floodplain management regulations that reduce future flood damage. For most participating communities, FEMA has prepared a detailed Flood Insurance Study. The study presents water surface elevations for floods of various magnitudes, including the 1-percent (100-year) annual chance flood and the 0.2-percent (500-year) annual chance flood. Base flood elevations and the boundaries of the 100- and 500-year floodplains are shown on Flood Insurance Rate Maps (FIRMs), which are the principle tool for identifying the extent and location of the flood hazard. FIRMs are the most detailed and consistent data source available, and for many communities they represent the minimum area of oversight under their floodplain management program. Those maps are identified to the right. The estimated probability of a flood occurring during any given year is identified in Table 1. The current number of NFIP insurance policies in force in Grays Harbor County are identified in Table 2. The NFIP also requires identification of severe or repetitive loss properties. These are structures meeting an identified threshold of previous flood claims identified in Table 3.

NFIP Insurance Policies in Force			
Community Name	Policies In-Force	Insurance In-Force	Premiums In-Force
Grays Harbor County	447	100,213,500	435,464
Aberdeen, City of	597	100,681,400	833,046
Cosmopolis, City of	11	2,060,000	4,858
Elma, City of	8	1,187,400	3,834
Hoquiam, City of	722	94,168,600	1,046,937
McCleary, City of	3	507,000	2,511
Montesano, City of	6	2,363,400	10,370
Oakville, City of	8	2,208,100	4,484
Ocean Shores, City of	613	174,046,900	260,944
Westport, City of	251	45,440,800	88,202

Source: <https://bsa.nfipstat.fema.gov/reports/1011.htm#WAT>  
Statistics as of 8/31/2017

Table 2 – NFIP Policies in Force

Community Rating System Status, Repetitive / Severe Repetitive Losses, and Flood Insurance Claims									
Community Name	CRS Community	Total Losses	Flood Claims Closed	Total Flood Loss Payments	Repetitive Loss Properties	Severe Repetitive Loss Properties	Total Flood Policies	Total Insurance Coverage	
Aberdeen, City of	NO	333	244	2,824,658	9	2	597	100,681,400	
Cosmopolis, City of	NO	4	4	5,927	0	0	11	\$2,060,000	
Elma, City of	NO	18	18	487,641	0	2	8	\$1,187,400	
Hoquiam, City of	NO	237	188	3,658,794	4	1	722	\$94,168,600	
McCleary, City of	NO	0	0	0	0	0	3	\$807,000	
Montesano, City of	NO	15	14	195,095	1	2	6	\$2,363,400	
Oakville, City of	NO	8	8	231,456	0	0	8	\$2,208,100	
Ocean Shores, City of	NO	23	12	194,080	0	0	613	\$174,046,900	
Westport, City of	YES- Class 8	13	8	127,860	0	0	251	\$45,440,800	
Unincorporated Grays Harbor County	NO	225	201	4,675,351	24	0	447	\$100,213,500	

Table 3 – Severe and Repetitive Loss Properties

## Vulnerability

Grays Harbor County has a history of flood events, and their numbers seem to be increasing, suggesting a high probability of occurrence. Based on exposure utilizing FEMA's identified 100- and 500-year flood event, the following number of structures are exposed to potential flooding.

Jurisdiction	Estimated Building Count (2)	Total Building Value (Structure and contents in \$) (2)	FEMA Flood Hazard Exposure (3)									
			Buildings Exposed to 1% Annual Chance Flood Event (2)					Buildings Exposed 0.2% Annual Chance Flood Event (2)				
			Buildings Exposed (2)	Value Structure in \$ Exposed (2)	Value Contents in \$ Exposed (2)	Total Value (Structure and contents in \$) Exposed (2)	% of Total Value	Buildings Exposed (2)	Value Structure in \$ Exposed (2)	Value Contents in \$ Exposed (2)	Total Value (Structure and contents in \$) Exposed (2)	% of Total Value
City of Aberdeen	6,331	\$1,558,813,283	2026	\$304,134,378	\$274,364,679	\$578,499,056	37.11%	2405	\$333,181,566	\$291,064,435	\$624,246,001	40.05%
City of Cosmopolis	740	\$219,110,855	13	\$1,423,410	\$955,705	\$2,379,115	1.09%	29	\$2,915,635	\$1,701,818	\$4,617,453	2.11%
City of Elma	1,225	\$345,049,384	4	\$421,365	\$368,800	\$790,165	0.23%	20	\$2,482,390	\$1,449,313	\$3,931,703	1.14%
City of Hoquiam	3,457	\$668,170,030	2859	\$245,427,550	\$174,524,228	\$419,951,778	62.85%	2859	\$245,427,550	\$174,524,228	\$419,951,778	62.85%
City of McCleary	664	\$138,539,384	21	\$2,923,895	\$1,461,948	\$4,385,843	3.17%	23	\$3,049,705	\$1,552,675	\$4,602,380	3.32%
City of Montesano	1,554	\$433,872,272	9	\$4,961,120	\$4,966,620	\$9,927,740	2.29%	9	\$4,961,120	\$4,966,620	\$9,927,740	2.29%
City of Oakville	331	\$66,998,060	2	\$178,190	\$94,595	\$272,785	0.41%	2	\$178,190	\$94,595	\$272,785	0.41%
City of Ocean Shores	4,600	\$1,156,337,793	88	\$23,626,135	\$11,965,515	\$35,591,650	3.08%	88	\$23,626,135	\$11,965,515	\$35,591,650	3.08%
City of Westport	1,291	\$310,030,743	93	\$21,584,022	\$13,018,661	\$34,602,683	11.16%	260	\$38,369,542	\$23,995,774	\$62,365,316	20.12%
Unincorporated Grays Harbor County	12,816	\$3,122,630,417	1507	\$198,438,115	\$153,107,655	\$351,545,770	11.26%	1575	\$262,720,324	\$239,858,171	\$502,578,495	16.09%
Other(4)	718	\$177,559,756	295	\$44,596,851	\$30,280,300	\$74,877,150	42.17%	295	\$44,596,851	\$30,280,300	\$74,877,150	42.17%
Grays Harbor County	33,727	\$8,197,111,976	6917	\$847,715,030	\$665,108,705	\$1,512,823,735	18.46%	7565	\$961,509,007	\$781,453,442	\$1,742,962,450	21.26%

Sources: (1) 2017 Washington Office of Financial Management April 2017 Population Estimate  
(2) Exposure numbers were estimated using FEMA Region X User Defined Facilities and Grays Harbor County Assessor data.  
(3) FEMA Flood analysis based on the current Effective DFIRM  
(4) "Other" includes Tribal, National Parks, and Military. Accurate population figures for this classification was not available at the time of this study.

## Types of Flooding in Grays Harbor County

1. **River or stream flooding** occurs with prolonged heavy rainfall, a rapidly melting snow pack, or a combination of these.
2. **Urban flooding** results from intense storms dropping large volumes of rain within a short period of time, exceeding the capacity of stormwater management systems.
3. **Tidal flooding** results when extremely high tides combine with low atmospheric pressure, excessive run-off, or strong northerly winds. The tides can also enhance flooding in delta areas when rivers or creeks are at or near flood stage. Sea level rise will exacerbate tidal flooding.
4. **Groundwater flooding** occurs when there is a high water table and persistent heavy rains. The situation is caused in areas where an upper, thin layer of permeable soils overlays an impermeable layer of hardpan. As the ground absorbs more rain, the groundwater table rises, resulting in flooding in areas where the land surface is below the water table.

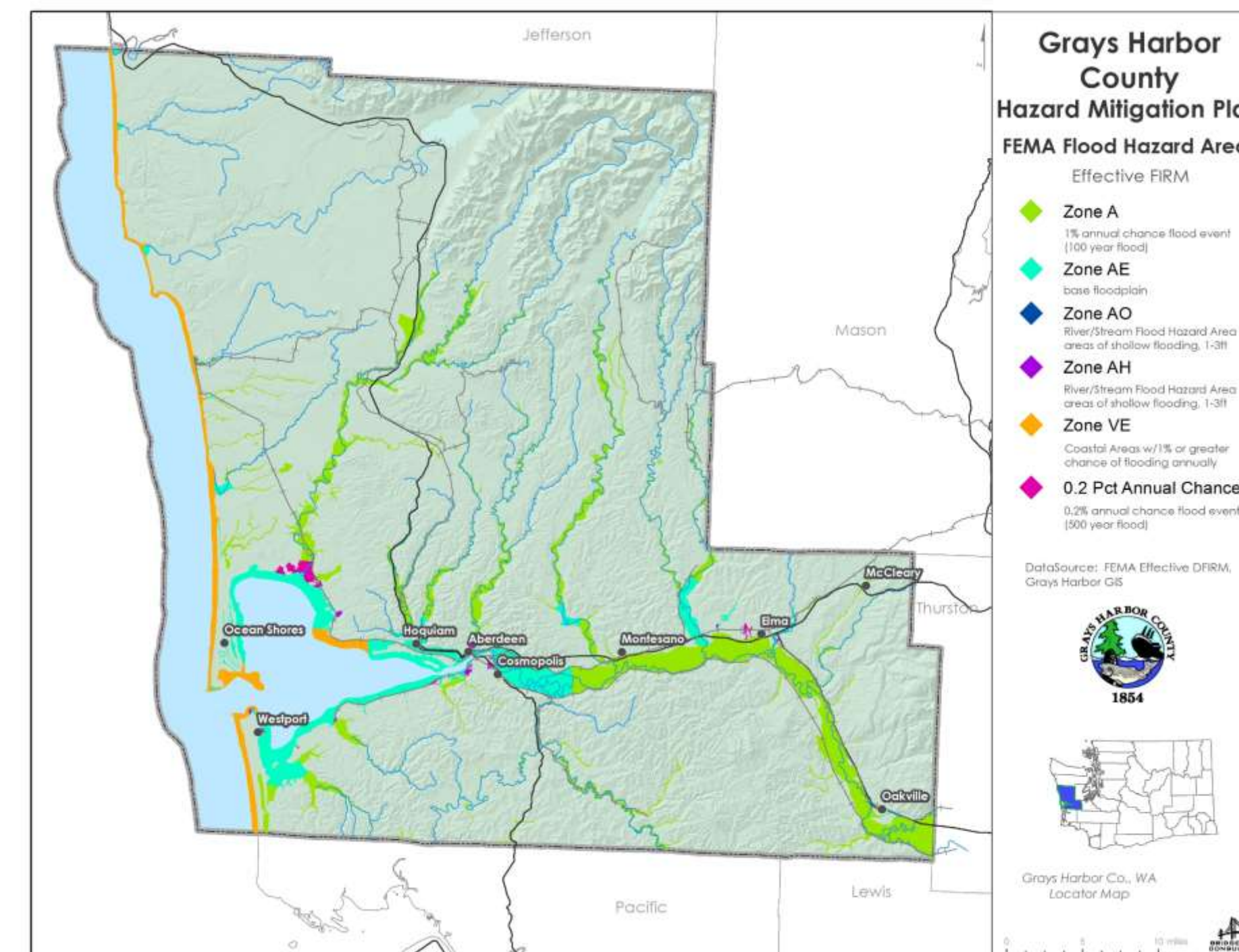
### Effects of Flooding

The effects of floods are devastating. Aside from inundation of lands and property with sediment-filled waters, floods also result in:

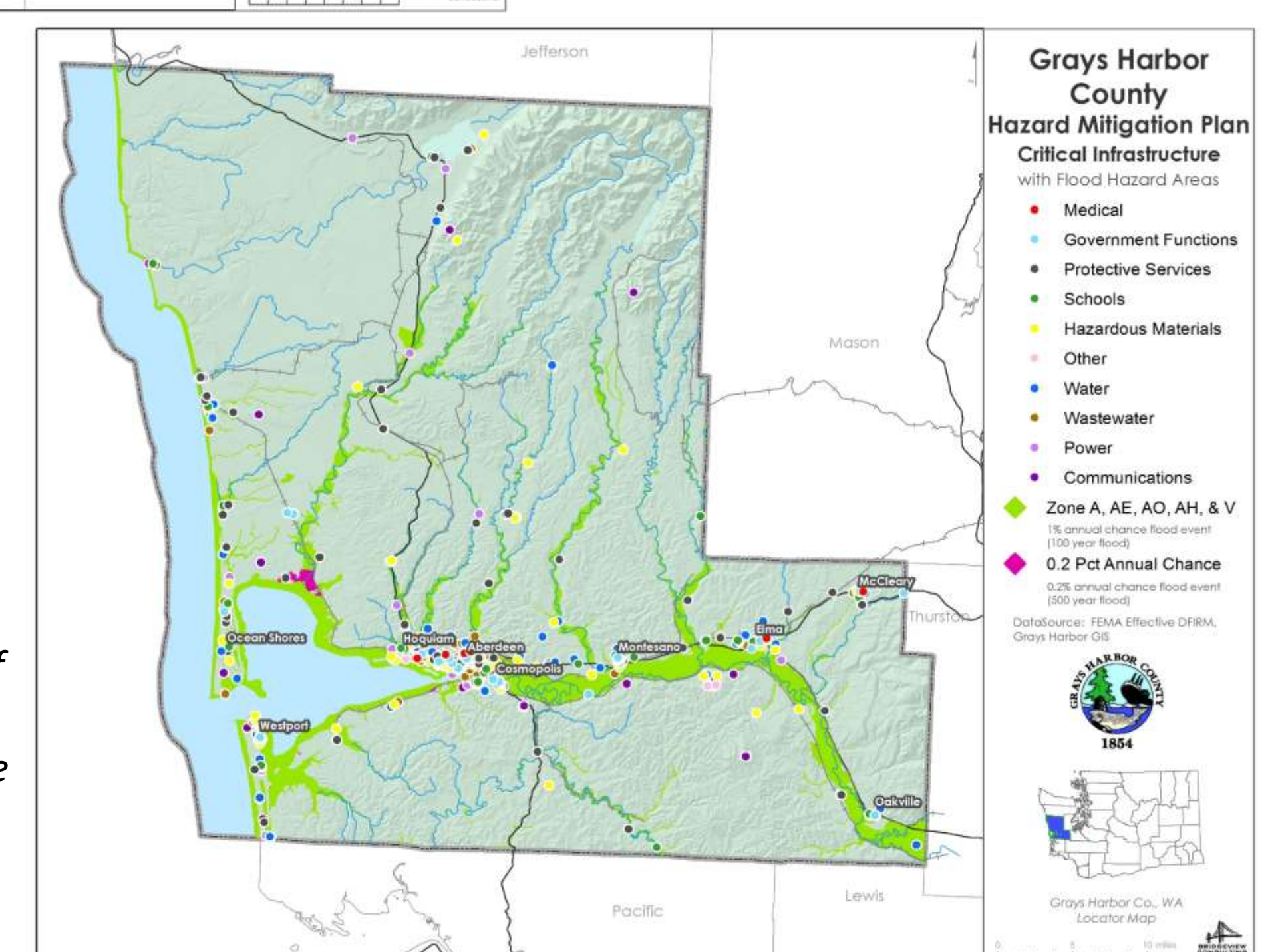
- Death or injury to people, pets, and livestock;
- People stranded or isolated for extended periods of time;
- Physical destruction of infrastructure which support communities, such as roads, bridges, railroads, pipelines, and utility systems;
- Contaminated water sources and water treatment systems;
- Compromised septic systems, destroyed electrical and heating systems;
- Restricted or limited access for emergency responders.

## Delineation of a Flood Hazard Area

For mitigation planning purposes, the flood hazard is delineated using the 2017 NFIP maps, combining the 100- and 500-year floodplains. It should be remembered that flooding does, and will continue to occur outside of these boundaries. The following maps illustrate the 100- and 500-year boundaries in Grays Harbor County.



Map 1: FEMA-identified Flood Hazard Areas



Map 2: Critical Infrastructure owned by the County and all of the cities and towns within Grays Harbor County which are exposed to potential flooding.



# Hazard Mitigation Risk Ranking



## Hazard Mitigation Plan Update

Grays Harbor County, its jurisdictions, and special purpose districts are embarking on a planning process to prepare for impacts of natural disasters. Responding to federal mandates in the Disaster Mitigation Act of 2000 (Public Law 106-390), Grays Harbor County Department of Emergency Management is updating its 2011 Hazard Mitigation Plan to enhance resilience throughout the County. During this process, local citizens will be asked to contribute by sharing knowledge of the area's vulnerability to hazards based on past occurrences.

### Countywide Planning Initiative Planning Partners Include

*Grays Harbor County  
Aberdeen  
Cosmopolis  
Elma  
Hoquiam  
McCleary  
Montesano  
Oakville  
Ocean Shores  
Westport*

*Port of Grays Harbor  
Grays Harbor Transit  
Grays Harbor PUD  
Grays Harbor Hospital District  
Summit Pacific Medical Center  
Grays Harbor College  
Fire District 2  
Fire District 5  
Fire District 7  
Fire District 8*

#### Types of Hazards Addressed

- Climate Change
- Drought
- Earthquake
- Erosion
- Flood
- Hazardous Materials
- Landslide
- Severe Weather
- Tsunami
- Volcano
- Wildfires

Since 1954, Grays Harbor County has  
**experienced 25 Disaster Events**  
**1 Earthquake / 12 Floods / 10 Severe Storms /**  
**1 Volcanic Eruption / 1 El Nino' Fish Loss**

GRAYS HARBOR COUNTY DISASTER HISTORY 1/1/1951 - 9/6/2017					
Disaster Number	Declaration Date	Incident Type	Title	Incident Begin Date	Incident End Date
4253	2/2/2016	Flood	Severe Winter Storm, Straight-Line Winds, Flooding, Landslides, Mudslides	12/1/2015	12/14/2015
4242	10/15/2015	Severe Storm(s)	Severe Windstorm	8/29/2015	8/29/2015
4056	3/5/2012	Severe Storm(s)	Severe Winter Storm, Flooding, Landslides, and Mudslides	1/14/2012	1/23/2012
1825	3/2/2009	Severe Storm(s)	Severe Winter Storm, Record and Near Record Snow	12/12/2008	1/5/2009
1817	1/30/2009	Flood	Severe Winter Storm, Landslides, Mudslides, and Flooding	1/6/2009	1/16/2009
1734	12/8/2007	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mudslides	12/1/2007	12/17/2007
1682	2/14/2007	Severe Storm(s)	Severe Winter Storm, Landslides, and Mudslides	12/14/2006	12/15/2006
1671	12/12/2006	Severe Storm(s)	Severe Storms, Flooding, Landslides, and Mudslides	11/2/2006	11/11/2006
1641	5/17/2006	Severe Storm(s)	Severe Storms, Flooding, Tidal Surge, Landslides, and Mudslides	1/27/2006	2/4/2006
1499	11/7/2003	Severe Storm(s)	Severe Storms and Flooding	10/15/2003	10/23/2003
1361	3/1/2001	Earthquake	Earthquake	2/28/2001	3/16/2001
1172	4/2/1997	Flood	Heavy Rains, Snow Melt, Flooding, Land and Mudslides	3/18/1997	3/28/1997
1159	1/17/1997	Severe Storm(s)	Severe Winter Storms, Land and Mudslides, Flooding	12/26/1996	2/10/1997
1100	2/9/1996	Flood	High Winds, Severe Storms, Flooding	1/26/1996	2/23/1996
1079	1/3/1996	Severe Storm(s)	Severe Storms, High Wind, and Flooding	11/7/1995	12/18/1995
1037	8/2/1994	Fishing Losses	The El Nino (The Salmon Industry)	5/1/1994	10/31/1994
883	11/26/1990	Flood	Severe Storms, Flooding	11/9/1990	12/20/1990
852	1/18/1990	Flood	Severe Storms, Flooding	1/6/1990	1/14/1990
623	5/21/1980	Volcano	Volcanic Eruption, Mt. St. Helens	5/21/1980	5/21/1980
612	12/31/1979	Flood	Storms, High Tides, Mudslides, Flooding	12/31/1979	12/31/1979
545	12/10/1977	Flood	Severe Storms, Mudslides, Flooding	12/10/1977	12/10/1977
492	12/13/1975	Flood	Severe Storms and Flooding	12/13/1975	12/13/1975
322	2/1/1972	Flood	Severe Storms and Flooding	2/1/1972	2/1/1972
300	2/9/1971	Flood	Heavy Rains, Melting Snow, Flooding	2/9/1971	2/9/1971
185	12/29/1964	Flood	Heavy Rains and Flooding	12/29/1964	12/29/1964

## Measuring Risk

Grays Harbor County uses a Calculated Priority Risk Ranking method to identify the level of risk and ranking of hazards of concern. Each hazard identified is reviewed based on their impact to the people, property, environment, and economy. In some cases, where specific geographic boundaries are not available, impact is more subjective in nature. In other instances, the risk is defined based on GIS and FEMA Hazus analysis, with updated critical facilities developed by our planning team. Check out the County's Hazard Mitigation Planning Webpage located on Grays Harbor County's Emergency Management website..

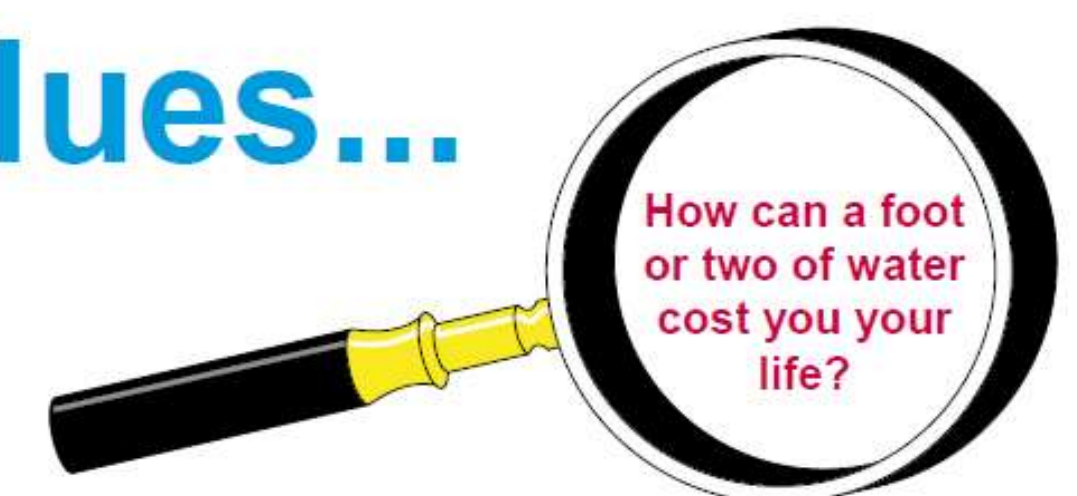
## Risk Assessment Summary

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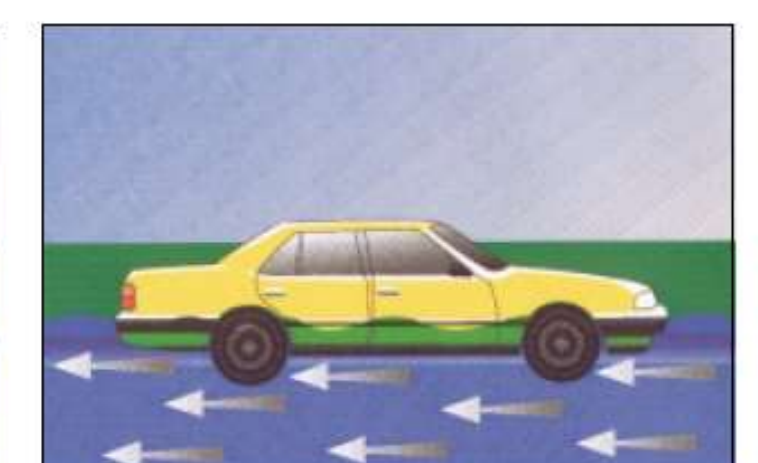
Rank	Hazard	CPRI Score	Level
1	Earthquake	3.85	High
2	Tsunami	3.3	High
3	Flood	3.1	High
4	Severe Weather	3.05	High
5	Landslides	2.95	High
6	Erosion	2.85	Medium
7	Wildfire	2.7	Medium
8	Other Hazards of Concern	2.65	Medium
9	Climate Change	2.35	Low
9	Drought	2.35	Low
10	Volcano	1.55	Low



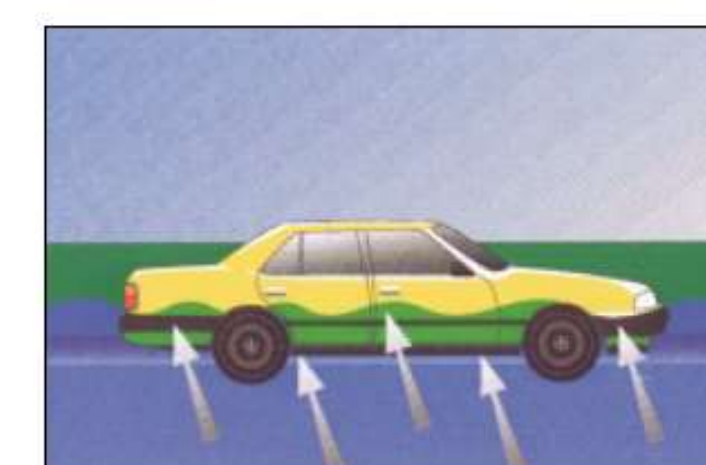
## Clues...



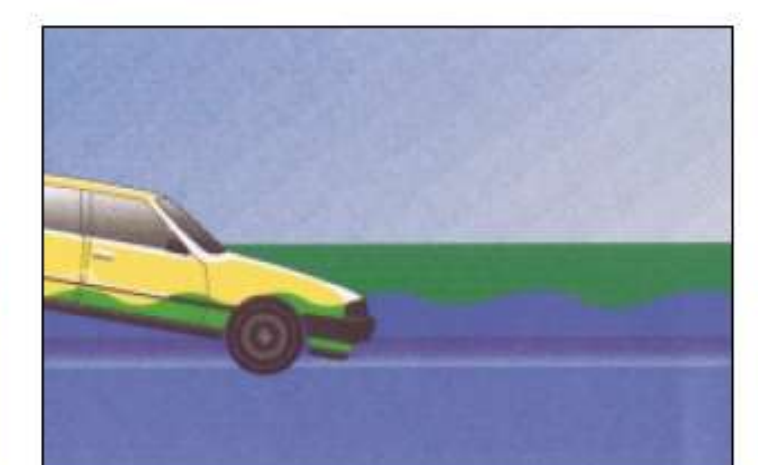
Water weighs 62.4 lbs. per cubic foot and typically flows downstream at 6 to 12 miles an hour.



When a vehicle stalls in the water, the water's momentum is transferred to the car. For each foot the water rises, 500 lbs. of lateral force are applied to the car.



But the biggest factor is buoyancy. For each foot the water rises up the side of the car, the car displaces 1,500 lbs. of water. In effect, the car weighs 1,500 lbs. less for each foot the water rises.



**Two feet of water will carry away most automobiles.**