Section 4

Risk Assessment Requirements

Identifying Hazards--- Requirement §201.6(c)(2)(i):

[The risk assessment **shall** include a] description of the type … of all natural hazards that can affect the jurisdiction.

- Does the plan include a description of the types of all hazards that affect the jurisdiction?
- Does the plan describe the sources used to identify the hazards?
- Does the plan indicate any data limitations?
- Does the plan provide an explanation for eliminating any hazards from consideration?

Profiling Hazard Events---Requirement §201.6(c)(2)(i):

[The risk assessment **shall** include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

- Does the risk assessment identify the location of each hazard being addressed in the plan?
- Does the risk assessment identify the extent of each hazard being addressed in the plan?
- Does the plan provide information on the previous occurrences of each natural hazard?
- Does the risk assessment identify for each hazard, a scale of likelihood of occurrence and the impact?
- Is the location of the natural hazard specifically defined?
- Is the quality of information on the extent above average
- Does the plan document the sources of the information on local, extent, and previous occurrences?

Assessing Vulnerability: Identifying Assets---Requirement §201.6(c)(2) (ii)(A):

[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community. The plan **should** describe vulnerability in terms of:§ The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas…

- Does the plan include an overall summary description of the jurisdiction vulnerability to the hazards?
- Does the plan address the impacts of the hazards on the community?
- Does the plan provide information on the types and numbers of vulnerable buildings--infrastructures--critical facilities?
- Does the plan address the vulnerability to future buildings, infrastructure, and critical facilities based on current planned development or anticipated areas of growth within the community?
- Does the plan identify the jurisdictions' repetitive loss areas/structures?

Assessing Vulnerability: Estimating Potential Losses---Requirement §201.6(c)(2) (ii)(B):

[The plan **should** describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate…

- Does the plan identify vulnerability assets as required in Part 201.6 (c)(ii)(A)?

Assessing Vulnerability: Analyzing Development Trends---Requirement §201.6(c)(2) (ii)(c):

[The plan **should** describe vulnerability in terms of providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

- Does the plan describe the vulnerability to hazards as required in 201.6(c)(ii)(a)?
- Does the plan indicate the methodology used to prepare the estimate?

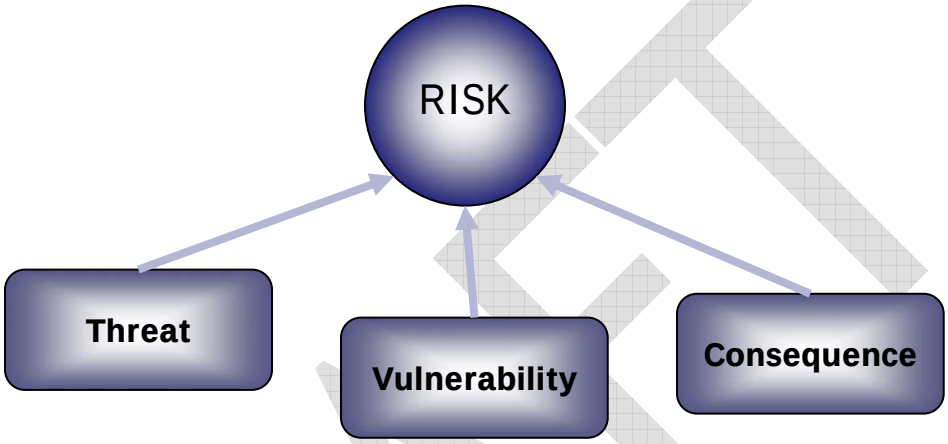
SECTION 4

REGION 5 HAZARD MITIGATION PLAN
MT RAINIER CHAPTER-AMERICAN RED CROSS
RISK ASSESSMENT SECTION

Table of Contents

Section Overview

The Risk Assessment portrays the threats of natural hazards, the vulnerabilities of a jurisdiction to the hazards, and the consequences of hazards impacting communities. Each hazard is addressed as a threat and is identified and profiled in the Hazard Identification. The vulnerabilities to and consequences of a given hazard are addressed in the Vulnerability Analysis. Vulnerability is analyzed in terms of exposure of both population and infrastructure to each hazard. Consequences are identified as anticipated, predicted, or documented impacts caused by a given hazard when considering the vulnerability analysis and the characteristics of the hazard as outlined in its identification.



The WA Region 5 **Hazard Identification** was used for this plan. Each jurisdiction's Vulnerability and Consequence Analysis are based on the Region 5 Hazard Identification. The Region 5 Hazard Identification can be found in Annex (TBD). Each hazard is identified in subsections. The subsections are grouped by hazard-type (i.e., geological and meteorological hazards) and then alphabetically within each type. A summary table of the WA Region 5 Hazard Identification is included in this section as Table 4-1a and Table 4-1b.

The **Vulnerability Analysis** is displayed in five tables:

- **Table 4-2 General Exposure**
- **Table 4-3 Population Exposure**
- **Table 4-4 General Infrastructure Exposure**
- **Table 4-5a Consequence Analysis Chart – Geological**
- **Table 4-5b Consequence Analysis Chart – Meteorological**

Each jurisdiction has its own Vulnerability Analysis, and it is included in this section.

The **Consequence Identification** is organized by Threat. Each threat page summarizes the hazard, graphically illustrates exposures from the Vulnerability Analysis, and lists corresponding Consequences. Each jurisdiction has its own Consequence Identification and it is included in this section: avalanche, earthquake, landslide, tsunami, volcanic, drought, flood, severe weather, and wildland/urban interface fire.

Specific information and analysis of a jurisdiction's owned (public) infrastructure is addressed in the Infrastructure Section of its Plan.

Table 4-1a WA Region 5 Hazard Identification Summary – Geological

	THREAT	DECLARATION # DATE/PLACE	PROBABILITY/RECURRENCE	MAPS AND FIGURES
Geological	**AVALANCHE**	TBD	TBD	TBD
	EARTHQUAKE	N/A--7/22/2001 Nisqually Delta N/A--6/10/2001 Satsop DR-1361-WA--2/2001 Nisqually N/A--7/2/1999 Satsop N/A--4/29/1965 Maury Island, South Puget Sound N/A--4/13/1949 South Puget Sound N/A--2/14/1946 Maury Island	Magnitude 4.3 Magnitude 5.0—Intraplate Earthquake Magnitude 6.8—Intraplate Earthquake Magnitude 5.8—Intraplate Earthquake Magnitude 6.5—Intraplate Earthquake Magnitude 7.0—Intraplate Earthquake Magnitude 6.3 100 years or less occurrence Best Available Science--About every 32 years for intraplate earthquakes	Earthquakes Types (TBD) Major Faults (TBD) County Seismic Areas (TBD) Major Earthquakes (TBD)
	LANDSLIDE	DR-1159-WA--12/96-2/1997 DR-852-WA--1/1990 DR-545-WA--12/1977	Unknown but anticipate an occurrence TBD	County Landslide/Soil Erosion Areas (TBD) County Slope Stability Areas (TBD)
	TSUNAMI	N/A--1894 Puyallup River Delta (did not induce tsunami) N/A--1943 Puyallup River Delta N/A--1949 Tacoma Narrows	Unknown but anticipate an occurrence TBD	Earthquake Sources of Tsunamis (TBD) Landslide Sources of Tsunamis (TBD) Historic Delta Failures (TBD) Shaded Relief of Puyallup Delta (TBD) Evidence of Past Delta Failures (TBD) WA State Tsunami Vulnerability (TBD) Puyallup Delta Seismic Activity (TBD) Puyallup River Delta (TBD) Nisqually River Delta (TBD) Nisqually River Delta Shaded Relief (TBD)
	VOLCANIC	DR-623-WA--5/1980	Unknown but rare occurrence Best Available Science--Case 1 Lahars 500 yr-1000yr and Case 2 Lahars 100yr-500yr	Volcanic Hazards (TBD) County Volcanic Areas (TBD)

Table 4- 1b WA Region 5 Hazard Identification Summary – Meteorological

	HAZARD	DECLARATION # DATE/PLACE		PROBABILITY/RECURRENCE	MAPS AND FIGURES
Meteorological	**DROUGHT**	DR-981-WA--1/1993 DR-137-WA--10/1962		TBD	TBD
	FLOOD Since 1978 3 Repetitive Loss Areas have produced 83 Claims totaling Nearly $1.78 Millions Dollars.	DR-1671-WA--11/2007 DR-1499-WA--10/2003 DR-1159-WA--12/96-2/1997 DR-1100-WA--1-2/1996 DR-1079-WA--11-12/1995 DR-896-WA--12/1990 DR-883-WA--11/1990	DR-852-WA--1/1990 DR-784-WA--11/1986 DR-545-WA--12/1977 DR-492-WA--12/1975 DR-328-WA--2/1972 DR-185-WA--12/1964 DR-137-WA--10/1962	25 years or less occurrence Best Available Science--The frequency of the repetitive loss claims indicates there is approximately a 33 percent chance of flooding occurring each year.	County Watersheds (TBD) County Flood Areas ((TBD) County Repetitive Loss Areas (TBD) Clear Creek Watershed (TBD) Clear Creek Flood Of Record (TBD)
	SEVERE WEATHER	DR-1682-WA--12/2007 DR-1671-WA--11/2007 DR-1159-WA--12/96-2/1997 DR-1152-WA--11/19/1996	DR-981-WA--1/1993 DR-137-WA--10/1962	100 years or less occurrence TBD	County Windstorm-South Wind Event (TBD) County Windstorm-East Wind Event (TBD)
	WUI FIRE	TBD		Unknown but anticipate an occurrence	WA State Fire Hazard (TBD) County Forest Canopy (TBD) WA State Fire Occurrences (TBD)

Table 4- 2 Vulnerability Analysis: General Exposure

THREAT		AREA (SQ MI)		PARCELS	
		Total	% Base	Total	% Base
BASE		**1687.90**	**100%**	**292,666**	**100%**
Geological	**Avalanche**[1]	NA	NA	NA	NA
	Earthquake[2]	299.15	18%	32,963	11%
	Landslide	137.50	8%	36,922	13%
	Tsunami[4]	TBD	TBD	TBD	TBD
	Volcanic[3]	210.34	12%	28,173	10%
Meteorological	**Drought**[4]	TBD	TBD	TBD	TBD
	Flood	470.13	28%	35,604	12%
	Severe Weather	1687.9	100%	292,666	100%
	WUI Fire[4]	TBD	TBD	TBD	TBD

Table 4- 3 Vulnerability Analysis: Population Exposure

THREAT		POPULATION			SPECIAL POPULATIONS (OF TOTAL EXPOSED POPULATION)			
		Total	% Base	Density (pop/sq mi)	65+ yrs		18- yrs	
					#	%	#	%
BASE		**700,820**	**100%**	**418**	**71,620**	**10%**	**190,569**	**27%**
Geological	**Avalanche**	NA	NA	NA	NA	NA	NA	NA
	Earthquake	140,153	20%	469	14,584	10%	36,915	26%
	Landslide	275,186	39%	2,001	26,121	9%	76,309	28%
	Tsunami	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Volcanic	74,895	11%	356	8,472	11%	19,571	26%
Meteorological	**Drought**	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Flood	286,873	41%	610	27,433	38%	79,083	28%
	Severe Weather	700,820	100%	418	71,620	10%	190,569	27%
	WUI Fire	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 4- 4 Vulnerability Analysis: General Infrastructure Exposure

THREAT		LAND VALUE			IMPROVED VALUE			TOTAL ASSESSED VALUE		
		Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)
BASE		**39,054,414,761**	**100%**	**133,444**	**47,992,756,413**	**100%**	**163,985**	**87,047,171,174**	**100%**	**297,428**
Geological	**Avalanche**	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Earthquake	6,742,243,500	17%	204,540	6,808,848,600	14%	206,560	13,551,092,100	16%	411,100
	Landslide	8,389,532,824	21%	227,223	8,750,177,413	18%	236,991	17,139,710,237	20%	464,214
	Tsunami	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Volcanic	5,651,424,000	14%	200,597	6,117,316,800	13%	217,134	11,768,740,800	14%	417,731
Meteorological	**Drought**	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	Flood	8,981,560,400	23%	252,263	7,598,273,017	16%	213,411	16,579,833,417	19%	465,673
	Severe Weather	39,054,414,761	100%	133,444	47,992,756,413	100%	163,985	87,047,171,174	100%	297,428
	WUI Fire	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 4-5a Consequence Analysis Chart – Geological[5,6]

THREAT		CONSEQUENCE	YES OR NO
Geological	**Avalanche[7]**	Impact to the Public	Yes
		Impact to the Responders	Yes
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	No
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	No
		Impact to Reputation or Confidence in Jurisdiction	No
	Earthquake	Impact to the Public	Yes
		Impact to the Responders	Yes
		Impact to COG and/or COOP in the Jurisdiction	Yes
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes[8]
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Landslide	Impact to the Public	Yes
		Impact to the Responders	Yes
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	No
		Impact to Reputation or Confidence in Jurisdiction	No
	Tsunami	Impact to the Public	Yes
		Impact to the Responders	Yes
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes[8]
		Impact to Reputation or Confidence in Jurisdiction	No
	Volcanic[9]	Impact to the Public	Yes
		Impact to the Responders	Yes
		Impact to COG and/or COOP in the Jurisdiction	Yes
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes[8]
		Impact to Reputation or Confidence in Jurisdiction	Yes

Table 4-5b Consequence Analysis Chart – Meteorological

THREAT		CONSEQUENCE	YES OR NO
Meteorological	**Drought**	Impact to the Public	Yes
		Impact to the Responders	No
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	No
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	No
		Impact to Reputation or Confidence in Jurisdiction	No
	Flood	Impact to the Public	Yes
		Impact to the Responders	No
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes[8]
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Severe Weather	Impact to the Public	Yes
		Impact to the Responders	Yes
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes[8]
		Impact to Reputation or Confidence in Jurisdiction	Yes
	WUI Fire	Impact to the Public	Yes
		Impact to the Responders	No
		Impact to COG and/or COOP in the Jurisdiction	No
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes[8]
		Impact to Reputation or Confidence in Jurisdiction	Yes

ENDNOTES

[1] Jurisdiction is not vulnerable to this hazard, therefore it is marked NA or non-applicable.
[2] It should be noted here that although all residents or Region 5 are vulnerable to earthquake shaking, not all are subject to the affects of liquefaction and liquefiable soils.
[3] The threat of volcanic ash fall affects the entire Region 5, however some jurisdictions are specifically threatened by lahar flows directly from Mt. Rainier; an active volcano.
[4] Jurisdiction is vulnerable to this hazard, but it has not been determined to what extent.
[5] Because the response and work of the American Red Cross exist throughout Region V the Impact Analyses in both Tables 4-5a and 4-5b, look at the impacts throughout the Region.
[6] The consideration for each of these hazards, in both Tables 4-5a and 4-5b, as to whether an individual hazard's consequences exist, or not, is based on a possible worst case scenario. It must also be understood that a "yes" means that there is a good possibility that the consequence it refers to could happen as a result of the hazard, not that it will. Conversely "No" means that it is highly unlikely that that consequence will have a major impact, not that there will be no impact at all.
[7] Because the American Red Cross is a County wide organization, responding to emergencies throughout the County, they could act in support of response to an avalanche emergency in eastern Pierce County.
[8] The American Red Cross's Economic Condition after a major disaster is frequently compromised by its support of the large number of communities it serves. For the Mt. Rainier Chapter this includes not only its response within Pierce County, but also to the other counties within its service area: Thurston, Mason, Lewis and Grays Harbor Counties.
[9] While the major volcanic hazard from Mt. Rainier is from a lahar descending the main river valleys surrounding the mountain, it is not the only problem. The Mt. Rainier Chapter of the American Red Cross, like the jurisdictions throughout Region V could receive tephra in greater or lesser amounts, sometimes with damaging results. Consequence analyses in this section take into account the possibility of tephra deposition in addition to a lahar.