Section 4

Risk Assessment Requirements

Identifying Hazards--- Requirement §201.7(c)(2)(i):

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

- Does the new or updated plan include a description of the **types of all natural hazards** that affect the tribal planning area?
- Does the new or updated plan describe the **tribal planning area**?

Profiling Hazards---Requirement §201.7(c)(2)(i):

[The risk assessment **shall** include a] description of the … location and extent of all natural hazards that can affect the tribal planning area. 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 l**ocation** (i.e., geographic area affected) of each hazard being addressed in the new or updated plan?
- Does the risk assessment identify the **extent** (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- Does the plan provide information on **previous occurrences** of each hazard addressed in the new or updated plan?
- Does the plan include the **probability of future events** (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?
- Does the updated plan address data deficiencies, if any, noted in the previously approved plan?

Assessing Vulnerability: Overview---Requirement §201.7(c)(2) (ii):

[The risk assessment **shall** include a] description of the Indian Tribal government'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.

- Does the new or updated plan include an **overall summary** description of the Indian tribe's **vulnerability** to each hazard?
- Does the new or updated plan address the **impacts** of each hazard on the Indian tribe?

Assessing Vulnerability: Addressing Repetitive Loss Properties---Requirement §201.7(c)(2) (ii):

[An Indian Tribal government may request the reduced cost share…under FMA and SRL programs…if they have an approved Tribal Mitigation Plan meeting the requirements of 201.7…and that]:

- Identifies actions the Indian Tribal government has taken to reduce the number of repetitive loss properties, (which must include properties identified as severe repetitive loss properties), and
- Specifies how the Indian Tribal government intends to reduce the number of such repetitive loss properties.

- Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties located in the identified hazard areas?

Assessing Vulnerability: Identifying Structures---Requirement §201.7(c)(2) (ii)(A):

[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 new or updated plan describe vulnerability in terms of the **types and numbers of existing** buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the new or updated plan describe vulnerability in terms of the **types and numbers of future** buildings, infrastructure, and critical facilities located in the identified hazard areas?

Assessing Vulnerability: Estimating Potential Losses---Requirement §201.7(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)(ii)(A) of this section and a description of the methodology used to prepare the estimate…

- Does the new or updated plan estimate **potential dollar losses** for vulnerable structures?
- Does the new or updated plan describe the **methodology** used to prepare the estimate?
- Does the updated plan reflect the effects of **changes in development** on loss estimates?

Assessing Vulnerability: Analyzing Development Trends---Requirement §201.7(c)(2) (ii)(c):

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

- Does the new or updated plan describe land uses and development trends within the tribal planning area?
- Does the updated plan reflect changes in development for tribal lands in hazard prone areas within the tribal area?

Assessing Vulnerability: Analyzing Cultural And Sacred Sites---Requirement §201.7(c)(2) (ii)(c):

[The plan **should** describe vulnerability in terms of] cultural and sacred sites that are significant, even if they cannot be valued in monetary terms.

- Does the new or updated plan describe significant cultural and sacred sites that are located in hazard areas?

SECTION 4

PUYALLUP TRIBE ALL HAZARD MITIGATION PLAN
2017-2022 EDITION
RISK ASSESSMENT

Table of Contents

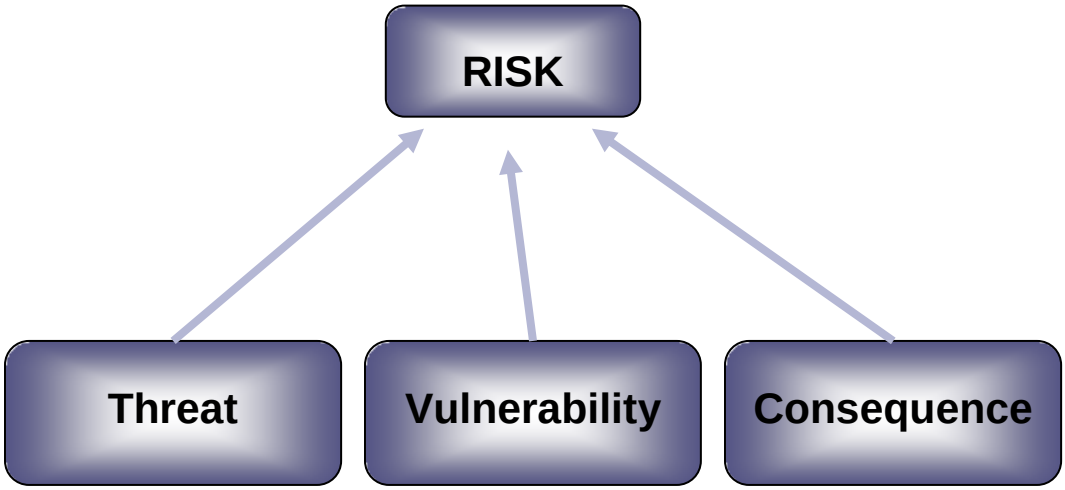
Risk

Various methodologies are available to facilitate risk assessment. A common approach based on an understanding of existing methodologies is needed to enable the setting of mitigation priorities across infrastructure sectors, both within and among jurisdictions. The first element of this approach was to establish a common definition and process for analysis of the basic factors of risk. In the context of homeland security, the Puyallup Tribe of Indians Emergency Management Committee (referred to as the Planning Team throughout this plan) developed a framework that assesses risk as a function of threat, vulnerability, and consequence.

- **Threat:** The likelihood or probability that a jurisdiction's assets, infrastructure, citizens or environment will suffer from a particular hazard.

- **Vulnerability:** The susceptibility of a jurisdiction, its assets, infrastructure, citizens or environment to damage, destruction, or incapacitation from a particular hazard. The likelihood is primarily dependent upon the location and extent of the hazard in relation to the infrastructure and/or jurisdiction.

- **Consequence:** The negative effects on public health and safety, the economy, public confidence in institutions, and the functioning of government, both direct and indirect, that can be expected if infrastructure is damaged, destroyed or disrupted by the impact of an individual hazard. The extent of these consequences depends on the level of mitigation that has taken place to decrease the threat, reduce the vulnerability, or negate the consequences.



For the purposes of this plan the Risk Assessment portrays the threats of natural and man-made hazards, the vulnerabilities of a jurisdiction to those hazards, and the consequences of those hazards on the individual communities or jurisdictions. 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. Thus the components of the Risk Assessment are: **hazard/threat identification**, **vulnerability analysis**, and **consequence analysis.**

Not only does DMA 2000 require a risk assessment, but Chapter 118-30 Washington Administrative Code requires that emergency management plans be based on a written assessment and listing of the hazards to which the political subdivisions are vulnerable. In addition state law requires each political subdivision to be part of an emergency management organization, and to have an emergency management plan. Over twenty years ago Pierce County Department of Emergency Management (PC DEM) began identifying the County's natural hazards to assist with its emergency planning. Eventually information on these hazards was compiled in its Hazard Identification and Vulnerability Analysis (HIVA). This document, revised from time to time, has been used as the basis for emergency response and operations planning for the County. The last iteration of this document includes format revisions, an expansion analysis of the hazard impacts within the county and is a foundation document for emergency planning in Pierce County. This document is now referred to as the Hazard Identification Risk Assessment (HIRA).Because the Puyallup Tribe's reservation resides primarily within Pierce County, the Pierce County HIRA provided a broad scope for looking at the hazards that affect the Reservation boundaries. Since most jurisdictions within the Reservation rely on the County for coordination in emergencies or disasters, the County's HIRA also forms the basis for much of their emergency planning.

The Puyallup Tribe's Vulnerability and Consequence Analysis is based on the Pierce County HIRA. Each hazard is identified in subsections.

Hazard Sub-Sections

The Risk Assessment portrays the risks and vulnerabilities and is divided by natural and man-made hazard types. In alphabetical order, separated by Geological (G) and Meteorological (M), and Technical (T) Hazards, the Puyallup Tribe of Indians All Hazard Mitigation Plan addresses the following hazards:

Geological

- **Avalanche Hazard (Sub-Section 4G.1),**
- **Earthquake Hazard (Sub-Section 4G.2),**
- **Landslide Hazard (Sub-Section 4G.3,**
- **Tsunami Hazard (Sub-Section 4G.4),**
- **Volcanic Hazard (Sub-Section 4G.5),**

Meteorological

- **Climate Change Hazard (Sub-Section 4M.1),**
- **Drought Hazard (Sub-Section 4M.2),**
- **Flood Hazard (Sub-Section 4M.3),**
- **Severe Weather Hazard (Sub-Section 4M.4),**

- **Wildland/Urban Interface (WUI) Fire Hazard (Sub-Section 4M.5),**

Technological

- **Abandoned Mines (Sub Section 4T.1),**
- **Civil Disturbance (Sub Section 4T.2),**
- **Dam Failure (Sub Section 4T.3),**
- **Energy Emergency (Sub Section 4T.4),**
- **Epidemic (Sub Section 4T.5),**
- **Hazardous Materials (Sub Section 4T.6),**
- **Pipeline Failure (Sub Section 4T.7),**
- **Terrorism (Sub Section 4T.8), and**
- **Transportation Accident (Sub Section 4T.9).**

Each hazard is discussed through an Identification Description (which includes the definition and types), a Profile (which includes the location and extent of the hazard, occurrences and the impacts), and includes a Resource Directory. Using this analysis, the Plan then describes the Planning area's vulnerability to each hazard. The specific vulnerabilities of each of the Planning Area's specific infrastructure are discussed in the Risk Assessment (Section 4) and Infrastructure Section (Section 6) of the plan.

The following tables and charts summarize the **Risk Assessment** processes:

- **Table 4-1a WA Region 5 Hazard Identification Summary-Geological**
- **Table 4-1b WA Region 5 Hazard Identification Summary-Meteorological**
- **Table 4-1c WA Region 5 Hazard Identification Summary-Technological**
- **Figure 4-1 Presidential Disaster Declarations - FEMA Regions**
- **Figure 4-2 Presidential Disaster Declarations - Washington State**
- **Table 4-2 Region 5 Disaster Assistance Summary**

The **Vulnerability Analysis** is displayed in nine tables and figures:

- **Table 4-3 General Exposure**
- **Figure 4-3 Vulnerability Analysis: Puyallup Tribe Area Square Miles Exposure**
- **Figure 4-4 Vulnerability Analysis: Puyallup Tribe Land Parcel Exposure**
- **Table 4-4 Vulnerability Population Exposure**
- **Figure 4-5 Vulnerability Analysis: Puyallup Tribe Population Exposure**
- **Table 4-5 General Infrastructure Exposure**
- **Table 4-6a Consequence Analysis Chart – Geological**
- **Table 4-6b Consequence Analysis Chart – Meteorological**
- **Table 4-6c Consequence Analysis Chart - Technological**

The **Consequence Identification** is organized by Threat. Each threat page summarizes the hazard, graphically illustrates exposures from the Vulnerability Analysis, and lists corresponding Consequences. The Puyallup Tribe of Indians has its own Consequence Identification and it is

included in this section: avalanche, earthquake, landslide, tsunami, volcanic, drought, flood, severe weather, wildland/urban interface fire, abandoned mines, civil disturbance, dam failure, energy emergency, epidemic, hazardous material spill, pipelines, terrorism, and transportation accidents.

Specific information and analysis of the Puyallup Tribe of Indian'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, FIGURES AND TABLES
Geological	**AVALANCHE**	Not Applicable	Yearly in the mountainous areas of the County including Mt. Rainier National Park and the Cascades.	Slab Avalanche Areas Vulnerable to Avalanche Pierce County Avalanches of Record
	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 5.9M DR-196-WA--4/29/1965 Maury Island, South Puget Sound 6.5M N/A--4/13/1949 South Puget Sound 7.1M N/A--2/14/1946 Maury Island 5.0M	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 - 40 years or less occurrence Historical Record—About every 23 years for intraplate earthquakes	Types of Earthquakes Major Faults in the Puget Sound Basin Seattle and Tacoma Fault Segments Pierce County Seismic Hazard Major Pacific Northwest Earthquakes Notable Earthquakes Felt in Pierce County Salmon Beach, Tacoma Washington following Feb 2001 Earthquake Liquefaction Niigata Japan-1964 Lateral Spreading – March 2001
	LANDSLIDE	DR-4168-WA—4/2014 DR-1361-WA—10/1998 DR-1159-WA--12/96-2/1997 DR-852-WA--1/1990 DR-545-WA--12/1977	Slides with minor impact (damage to 5 or less developed properties or $1,000,000 or less damage) 10 years or less. Slides with significant impact (damage to 6 or more developed properties or $1,000,000 or greater damage) 100 years or less.	Northeast Tacoma Landslide January 2007 Pierce County Landslide and Soil Erosion Hazard Pierce County Shoreline Slope Stability Areas Notable Landslides in Pierce County Ski Park Road – Landslide January 2003 SR-165 Bridge Along Carbon River – Landslide February 1996 Aldercrest Drive - Landslide
	TSUNAMI	N/A--1894 Puyallup River Delta N/A--1943 Puyallup River Delta (did not induce tsunami) N/A--1949 Tacoma Narrows	Due to the limited historic record, until further research can provide a better estimate a recurrence rate of 100 years plus or minus will be used.	Hawaii 1957 – Residents Explore Ocean Floor Before Tsunami Hawaii 1949 – Wave Overtakes a Seawall Puget Sound Fault Zone Locations, Vertical Deformation and Peak Ground Acceleration Seattle and Tacoma Faults Tsunami Inundation and Current Based on Earthquake Scenario Puget Sound Landslide Areas and Corresponding Tsunamis Puget Sound River Deltas, Tsunami Evidence and Peak Ground Acceleration Salmon Beach, Pierce County 1949 – Tsunamigenic Subaerial Landslide Puyallup River Delta – Submarine Landslides Puyallup River Delta – Submarine Landslides and Scarp Damage in Tacoma from 1894 Tsunami
	VOLCANIC	DR-623-WA--5/1980	The recurrence rate for either a major lahar (Case I or Case II) or a major tephra eruption is 500 to 1000 years.The recurrence rate for either a major lahar (Case I or Case II) or a major tephra eruption is 500 to 1000 years.	Volcano Hazards Debris Flow at Tahoma Creek – July 1988 Douglas Fir Stump – Electron Lahar Deposit in Orting Landslide from Little Tahoma Peak Covering Emmons Glacier Tephra Types and Sizes Lahars, Lava Flows and Pyroclastic Hazards of Mt. Rainier Estimated Lahar Travel Times for Lahars 10_7 to 10_8 Cubic Meters in Volume Ashfall Probability from Mt. Rainier Annual Probability of 10 Centimeters or more of Tephra Accumulation in the Pacific NW Cascade Eruptions Mt. Rainier Identified Tephra, last 10,000 years Pierce County River Valley Debris Flow History

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

	HAZARD	FEMA DECLARATION # DATE/PLACE		PROBABILITY/ RECURRENCE	MAPS, FIGURES AND TABLES
Meteorological	**CLIMATE CHANGE**	Not Applicable		Not Applicable	Global Temperature Change: 1850 to 2006 Recent and Projected Temperatures for the Pacific Northwest Comparison of the South Cascade Glacier: 1928 to 2003 Lower Nisqually Glacier Retreat: 1912 to 2001
	DROUGHT	DR-981-WA -- 1/1993 DR-137-WA -- 10/1962 Emergency Declaration EM-3037 3/1977		50 years or less occurrence	Sequence of Drought Impacts Palmer Drought Severity Index Pierce County Watersheds %Area of Basin in Drought Conditions Since 1895 %Time in Severe to Extreme Drought: 1895-1995 %Time in Severe to Extreme Drought: 1985-1995 Notable Droughts Affecting Pierce County Columbia River Basin USDA Climate Zones – Washington State
	FLOOD Since 1978 3 Repetitive Loss Areas have produced 83 Claims totaling Nearly $1.78 Million Dollars.	DR-4168-WA-- 3/22-4/29/2014 DR-WA 1817--01/2009 DR-1734-WA--12/2007 DR-1671-WA--11/2006 DR -1641-WA – 1/27-2/4/2006 DR-1499-WA--10/2003 DR- 1252-WA—5/1998 DR-1159-WA--12/96-2/97 DR-1182-WA-- 4/10-6/30/1997	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-822-WA – 3/1989 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	5 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.	Pierce County Watersheds Pierce County Flood Hazard Pierce County Repetitive Loss Areas Clear Creek Basin Repetitive Flood Loss Aerial Photo Flood Hazard Declared Disasters Feb 8, 1996 Flooding – Del Rio Mobile Homes Along Puyallup River Nov 2006 Flooding River Park Estates – Along Puyallup River Nov 2006 Flooding State Route 410 – Along Puyallup River Nov 2006 Flooding Rainier Manor – Along Puyallup River
	SEVERE WEATHER	DR-4253-WA-- 12/2015 DR-4249-WA-- 11/2015 DR-4242-WA-- 8/2015 DR-4083-WA-- 7/2012 DR-4056-WA-- 01/2012 DR-1963-WA -- 1/2011 DR-1825- WA – 12/2008 – 01/2009 DR-1682-WA--12/2006 DR-1159-WA--12/96-2/1997 DR-1152-WA--11/19/1996	DR-981-WA--1/1993 DR-1172-WA--3/1997 DR-137-WA--10/1962	The recurrence rate for all types of severe storms is 5 years or less.	Fujita Tornado Damage Scale Windstorm Tracks Pierce County Severe Weather Wind Hazard – South Wind Event Pierce County Severe Weather Wind Hazard – East Wind Event Notable Severe Weather in Pierce County Snowstorm January 2004 Downtown Tacoma Satellite Image – Hanukkah Eve Windstorm Before/After Tornado Damage Greensburg KS May 2007 Public Works Responds 2005 Snowstorm Downed Power Pole February 2006 Windstorm County Road December 2006 Windstorm Tacoma Narrows Bridge – November 1940 Windstorm
	WUI FIRE	DR-4243-WA—8/9-9/10/2015 DR-4188-WA-- 7/9-8/6/2014 DR-922-WA-- 10/1991		Based on information from WA DNR the probability of recurrence for WUI fire hazard to Pierce County is 5 years or less.	Washington State Fire Hazard Map Pierce County Forest Canopy Industrial Fire Precaution Level Shutdown Zones Carbon Copy Fire August 2006 Washington State DNR Wildland Fire Statistics: 1973-2007 DNR Wildland Response South Puget Sound Region: 2002-2007 Pierce County DNR Fires

Table 4-2c Region 5 Hazard Identification Summary – Technological

	HAZARD	FEMA DECLARATION # DATE/PLACE	PROBABILITY/ RECURRENCE	MAPS, FIGURES AND TABLES
Technological	**ABANDONED MINES**	Not Applicable	Based on Information from WA DNR The Pierce County Sheriff's Department reports that they have had very few incidents of citizens entering the abandoned mines in eastern Pierce County. [1] Isolated issues of minor subsidence have occurred, typically following flood events in 2009/2010	Pierce County – Mine Hazard Areas MapBased on WA DNR Information (www.dnr.wa.gov/geology) Schasse, Koler, Eberle, and Christie, The Washington State Coal Mine Map Collection: A Catalog, Index, and User's Guide, Open File Report 94-7, June 1984 Pierce County 2009 HIRA
	CIVIL DISTURBANCE	Not Applicable	Looking at the historical record, major civil unrest is a rare occurrence.[2] Movement of military supplies from Port of Tacoma to Joint Base Lewis McChord[3]	Pierce County Civil Disturbance Map Pierce County 2009 HIRA Hilltop Riots Tacoma 1969, 1991
	DAM FAILURE	Not Applicable	No occurrences in Pierce County 50+ years recurrence[4]	Table D-1 PC Dams that Pose a High or Significant Risk, Pierce County 2009 HIRA Table D-2 Dam Failures in WA State
	ENERGY EMERGENCY	Not Applicable	• January 2009 Loss of electricity to Anderson Island (underground [water] cable) Power Outage is the most frequent energy incident, via natural hazards (storms, ice)[5] Recurrence Rate – 5 years (storms) Recurrence Rate – 50+ years (major)	Pierce County 2009 HIRA Tacoma Power Outage 1929, USS Lexington provide power Anderson Island January 2009 Underwater power cable broke
	EPIDEMIC	Not Applicable	Pandemics • 2009-2010 "Swine Flu Recurrence Rate – 20 years[6]	Pierce County 2009 HIRA Tacoma Pierce County Health District Pan Flu Plan Measles, State of WA, 1990 E Coli, January 1993, September 1998
	HAZARDOUS MATERIALS	Not Applicable	• Dalco Passage oil spill of October 13, 2004 • Chlorine Spill Port of Tacoma February 12, 2007 Large Incidents 5 year recurrence[7] Small Incidents 1 week recurrence	Pierce County 2009 HIRA Table HM-1 Reported Releases (in lbs.)of all chemicals, for Pierce Co. in 2008, all industries Chlorine Spill in the Port of Tacoma (February 12, 2007) Dalco Passage oil spill (October 13, 2004) Illegal methamphetamine sites (A high of 258 sites in 2001-56 sites in 2009
	PIPELINE FAILURE	Not Applicable	• Northwest Pipeline Corporation natural gas incident May 1st 2003, in Sumner 10 years recurrence	Map P-1 Pierce County Pipelines[8] Pierce County 2009 HIRA
	TERRORISM	Not Applicable	Minor PC Incident –Recurrence 1-year Major Incident – Recurrence 100 years[9]	Pierce County 2009 HIRA Tacoma's Model Cities and Human Rights Offices burned 1972 African American church burned 1993 White Supremacy Group Hate Crimes, 1998 Westgate Family Medicine Clinic bombed, 2011
	TRANSPORTATION ACCIDENT	Not Applicable	Minor Incidents occur daily Major Incidents rare Recurrence Rate – 10 years[10]	Pierce County 2009 HIRA Rail: Freight Derailment, Steilacoom 1996 Freight Train Derailment, Chambers Bay, 2011

Figure 4-1 Presidential Disaster Declarations - FEMA Regions

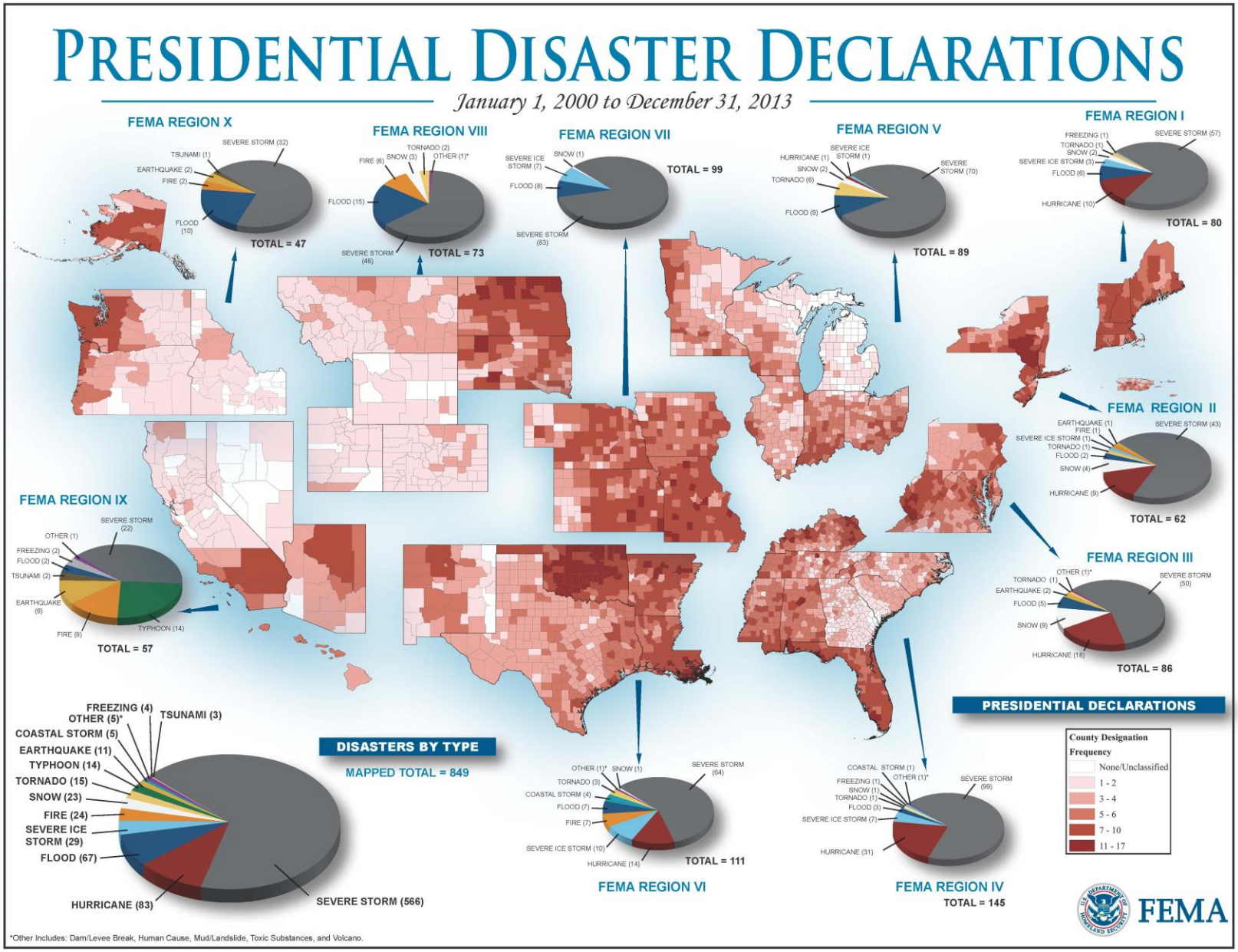


Figure 4-2 Presidential Disaster Declarations - Washington State

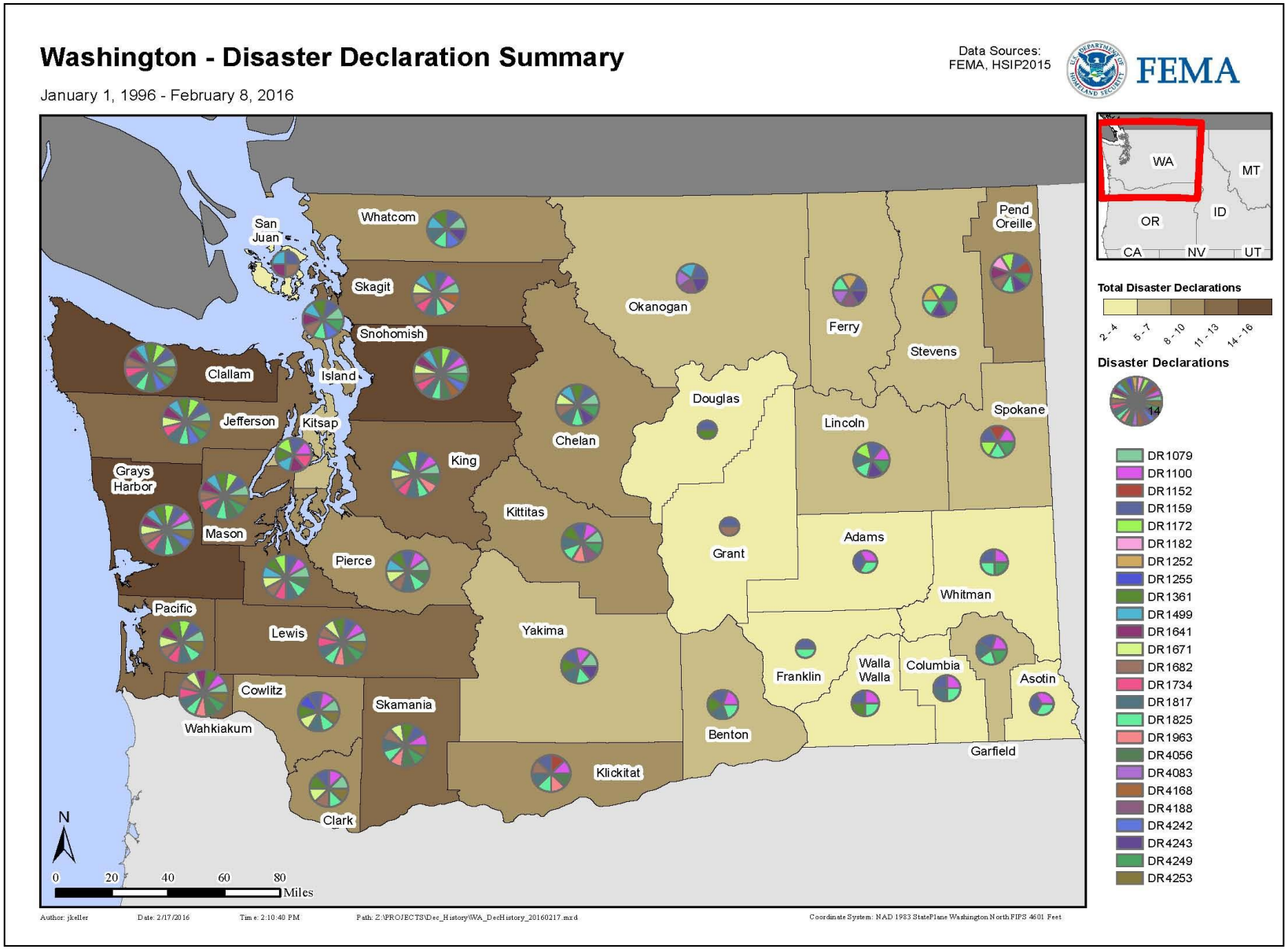


Table 4-2 Region 5 Disaster Assistance Summary

DISASTER NUMBER	IHP* PROGRAM		PA* PROGRAM	HMGP* PROGRAM	SBA* PROGRAM
YEAR EVENT	IFG/ONA* AWARDS TOTAL $	DH/HA* AWARDS TOTAL $	PROJECTS TOTAL $	PROJECTS TOTAL $	TOTAL LOANS--$ HOME LOANS--$ BUSINESS LOANS--$
DR-852-WA, January 1990 Flood	TBD	TBD	72 DSR $934,049	N/A	TBD
DR-883-WA, November 1990 Winter Storms & Flooding	TBD	TBD	33 DSR $1,403,390	N/A	TBD
DR-981-WA, January 1993 Inaugural Day Windstorm	N/A	N/A	33 DSR $2,055,811	5 PR $372,361	TBD
DR-1079-WA, Nov.-Dec.1995 Winter Storms and Flooding	4 Awards $16,515	8 Awards $17,340	3 DSR $52,662	1 PR $750,000	5 Loans--$47,200 HL--3--$22,300 BL--2--$24,900
DR-1100-WA, February 1996 Winter Storms and Flooding	305 Awards $1,112,639	892 Awards $2,325,889	90 DSR $7,194,590	1 PR $2,035,032	284 Loans--$9,257,300 HL--235--$7,656,300 BL--49--$1,601,000
DR-1159-WA, Dec. 1996- Feb. 97 Winter Storms and Flooding	107 Awards $291,083	310 Awards $530,000	21 DSR $3,671,728	3 PR $2,944,335	89 Loans--$1,428,300 HL--58--$688,800 BL--31--$739,500
DR-1361-WA, February 2001 Nisqually Earthquake	670 Awards $869,284	5820 Awards $10,810,619	24 PW $654,571.34	3 PL $155,000	1172 Loans--$12,461,400 HL--1059--$10,311,600 BL--113--$2,149,800
DR-1499-WA, October 2003 Flooding	5 Awards $3,189	37 Awards $74,742	$9,125,551	N/A	TBD
DR-1671-WA, November 2006 Flooding and Severe Weather	TBD	TBD	27 PW $4,529,568	15 PR $9,111,196	TBD
DR-1682-WA, December 2006 Windstorm	TBD	TBD	8 PW $459,566	Applications Pending	TBD
DR-1734-WA, December 2007 Flooding and Severe Weather	N/A	N/A	$60,627,680	8 PR $7,627,409	4020 Loans-- $21,160,441 HL-- $17,930,951 BL-- $3,229,489
DR-1817-WA, Dec 2008-Jan 2009 Severe Weather and Flooding	TBD	TBD	42 PW $1,213,419.27	27 PR $12,197,268	TBD
DR-1825-WA December 2009 Severe Weather & Record Snow	TBD	TBD	1 PW $186, 540.17	Applications Pending	TBD
DR-1963-WA, January 2011 Severe Winter Storm, Flooding, Landslides, and Mudslides			$3,480,030	4 PR $$1,534,746	
DR-4056-WA, January 2012 Severe Storm, Straight-line Winds, and Flooding			$29,701,941	17 PR $5,895,536	

DISASTER NUMBER	IHP* PROGRAM		PA* PROGRAM	HMGP* PROGRAM	SBA* PROGRAM
YEAR EVENT	IFG/ONA* AWARDS TOTAL $	DH/HA* AWARDS TOTAL $	PROJECTS TOTAL $	PROJECTS TOTAL $	TOTAL LOANS--$ HOME LOANS--$ BUSINESS LOANS--$
DR-4083-WA September 2012 Severe Winter Storm, Straight-Line Winds, Flooding, Landslides, and Mudslides			$2,860,240	yes	
DR-4188-WA August 2014 Washington Wildfires			$24,301,564	yes	
DR-4168-WA March 2014 Washington Flooding and Mudslides (SR 530 Slide)	IH Program		$28,535,362		595 Loans--$12,461,400 HL--595 Loans--$12,461,400 BL--
DR-4188-WA July 2014 Washington Wildfires and Mudslides			$24,301,564		
DR-4242-WA August 2015 Washington Severe Storm			$5,996,564	Estimate $3m	
DR-4243-WA August 2015 Washington Wildfires and Mudslides			$10,523,983	Estimate $8m	
DR-4249-WA November 2015 Severe Winter Storm, Straight-Line Winds, Flooding, Landslides, and Mudslides			$8,529,488	Estimate $3.1m	
DR-4253-WA December 2015 Severe Winter Storm, Straight-Line Winds, Flooding, Landslides, and Mudslides			$1,937,480	Estimate $2.4m	no
TOTALS	1091 Awards $2,292,710	7067 Awards $13,758,590	354 DSR/PW $22,355,894.88	13 PR $6,101,729	1550 Loans--$23,194,200 HL--1355--$18,679,00 BL--195--$4,515,200

*TBD=To Be Determined. N/A= Not Applicable.

*IHP=Individual and Households Program. Due to DMA2KIFG (Individual and Family Grants Program) replaced by ONA (Other Needs Assistance) and DH (Disaster Housing Program) replaced by HA (Housing Assistance Program), hence this affects total for all disasters starting with DR-1499-WA for Washington State.

*PA=Public Assistance Program. DSR=Damage Survey Reports. PW=Project Worksheets. For DR-1100-WA, 3 DSR totaling $8,480,750.00 were not included, more information to gather. PA totals are for The "Jurisdiction" of Pierce County, other PA for all jurisdictions are still being compiled.

*HMGP=Hazard Mitigation Grant Program. PR=Projects. PL=Plans. PC=The "Jurisdiction" of Pierce County, the jurisdiction had a total of 4 PR for totaling $5,680,209.

*SBA=Small Business Administration. HL= Home Loans. BL= Business Loans.

Vulnerability Analysis

Table 4-3 Vulnerability Analysis: General Exposure[11]

THREAT[12]			AREA (SQ MI)		PARCELS	
			Total	% Base	Total	% Base
RESERVATION BASE (R)			**28.89[13]**	**100%**	**18,534[14]**	**100%**
TRIBAL TRUST BASE (PTI)			**2.17**	**100%**	**393**	**100%**
Geological	**Avalanche[15]**	R	NA	NA	NA	NA
		PTI	NA	NA	NA	NA
	Earthquake Liquefaction Potential[16]	R	11.86	48.7%	4,791	25.2%
		PTI	1.33	37.3%	162	33.4%
	Landslide	R	3.65	15.0%	1,516	8.0%
		PTI	1.58	44.3%	30	6.2%
	Tsunami (based on Seattle Fault	R	6.12	25.1%	2,023	10.6%
		PTI	.59	16.5%	95	19.6%
	Volcanic[17]	R	12.37	50.8%	5,139	27.0%
		PTI	1.51	42.2%	174	35.9%
Meteorological	**Drought[18]**	R	28.89	100%	19,048	100%
		PTI	3.57	100%	485	100%
	Flood	R	8.73	35.8%	4,051	21.3%
		PTI	1.06	29.7%	150	30.9%
	Severe Weather	R	28.89	100%	19,048	100%
		PTI	3.57	100%	485	100%
	WUI Fire[19]	R	NA	NA	NA	NA
		PTI	NA	NA	NA	NA

THREAT[20]			AREA (SQ MI)		PARCELS	
			Total	% Base		Total
RESERVATION BASE (R)			28.89	100%	RESERVATION BASE (R)	19,048
TRIBAL TRUST BASE (PTI)			3.57	100%	TRIBAL TRUST BASE (PTI)	485
Technological	Abandoned Mines[21]	R	0	0	0	0
		PTI	0	0	0	0
	Civil Disturbance[22]	R	28.89	100%	19,048	100%
		PTI	3.57	100%	485	100%
	Dam Failure[23]	R	12.40	50.9%	4,983	26.2%
		PTI	1.11	31%	169	34.8%
	Energy Emergency[24]	R	28.89	100%	19,048	100%
		PTI	3.57	100%	485	100%
	Epidemic[25]	R	28.89	100%	19,048	100%
		PTI	3.57	100%	485	100%
	Hazardous Material Railroad[26]	R	1.44	5.9%	699	3.7%
		PTI	.15	4.1%	34	7%
Technological	Hazardous Material Roads	R	2.50	10.2%	1,563	8.2%
		PTI	.39	10.9%	139	28.7%
	Pipeline Hazard[27]	R	4.10	16.8%	1,070	5.6%
		PTI	.08	2.4%	31	6.4%
	Terrorism[28]	R	28.89	100%	19,048	100%
		PTI	3.57	100%	485	100%
	Transportation Accidents -	R	3.06	12.6%	1,305	6.9%

	Shoreline[29]	PTI	.39	1.6%	60	7.5%
	Transportation Accidents - Railroad	R	1.44	5.9%	699	3.7%
		PTI	.15	4.1%	34	7.0%
	Transportation Accidents – Roads	R	2.50	10.2%	1,563	8.2%
		PTI	.39	10.9%	139	28.7%

Vulnerability Analysis Update for 2017

As previously stated in the Profile Section, the Puyallup Reservation is located within a highly urbanized portion of Pierce County, has continued to show an increase in population the past five years and is beginning to show signs of rebounding economically with land values. All of these factors contribute to the hazard analysis as it did with the Profile Section of the plan. The Tribe has continued to secure more lands in Tribal Trust Properties and property values are beginning to rebound after years of declining values. Tables 4-3, 4-4, and 4-5 are divided into two rows per hazard, the "R" standing for the Puyallup Tribe Reservation boundary and "PTI" for the Puyallup Tribe Tribal Trust Lands. The Reservation boundary can show an overall trend in vulnerability and risk for each of the hazards but the Puyallup Tribe only has jurisdictional authority over their Tribal Trust Lands to reduce and mitigate hazards.

Tables 4-3, 4-4, and 4-5 are showing the current 2017 values for area, population and infrastructure at risk and do not include the previous plan data. Earthquake, volcanic (lahar), flood and landslide pose the greatest risk to the Puyallup Tribe Trust Lands and Tables 4-7a, b, 4-8a, b and 4-9a, b provide data comparisons with the 2012 and 2017 for hazard analysis. Detailed maps to parcel levels clearing identify Tribal Trust Lands at risk are included in the hazard sub-sections of this plan. Landslide will not be included in comparing the two sets of data due to the inability to compare the exact same landslide data that was used in 2012. That data set is no longer available in the same format. The data for the earthquake liquefaction potential and the flood data are both somewhat different than what was used for the last plan version but both sets of data are used for comparison in Tables 4-7a though 4-9b. Drought and severe weather are portrayed at 100 percent with both plans because the entire area is at risk for both of these meteorological events.

A total comparison between the two plan versions is somewhat subjective in population figures due to the Census boundaries changing for the block group area, which the analysis is taken. The boundaries are not the same as 2012 and are pulling population numbers from entirely different geographical areas. The Tribe has additional lands in Tribal Trust so the same geographical areas if they were the same would be including a larger area with the 2017 plan. Due to the varying discrepancies in data between the two plans an analysis comparing them would be totally skewed and therefore it was decided not proceed with it.

Figure 4-3 Vulnerability Analysis: Puyallup Tribe Reservation Area Square Miles Exposure

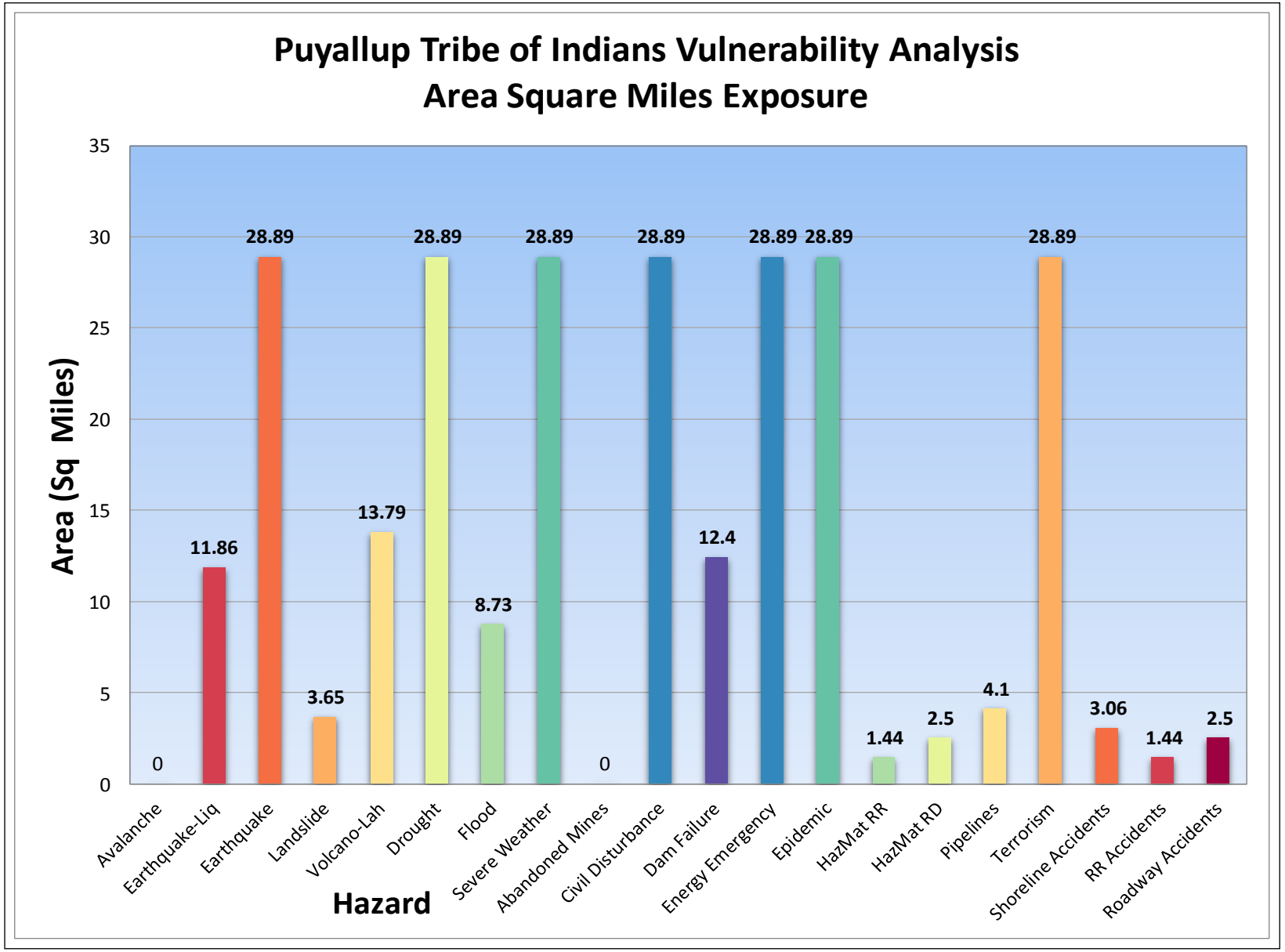
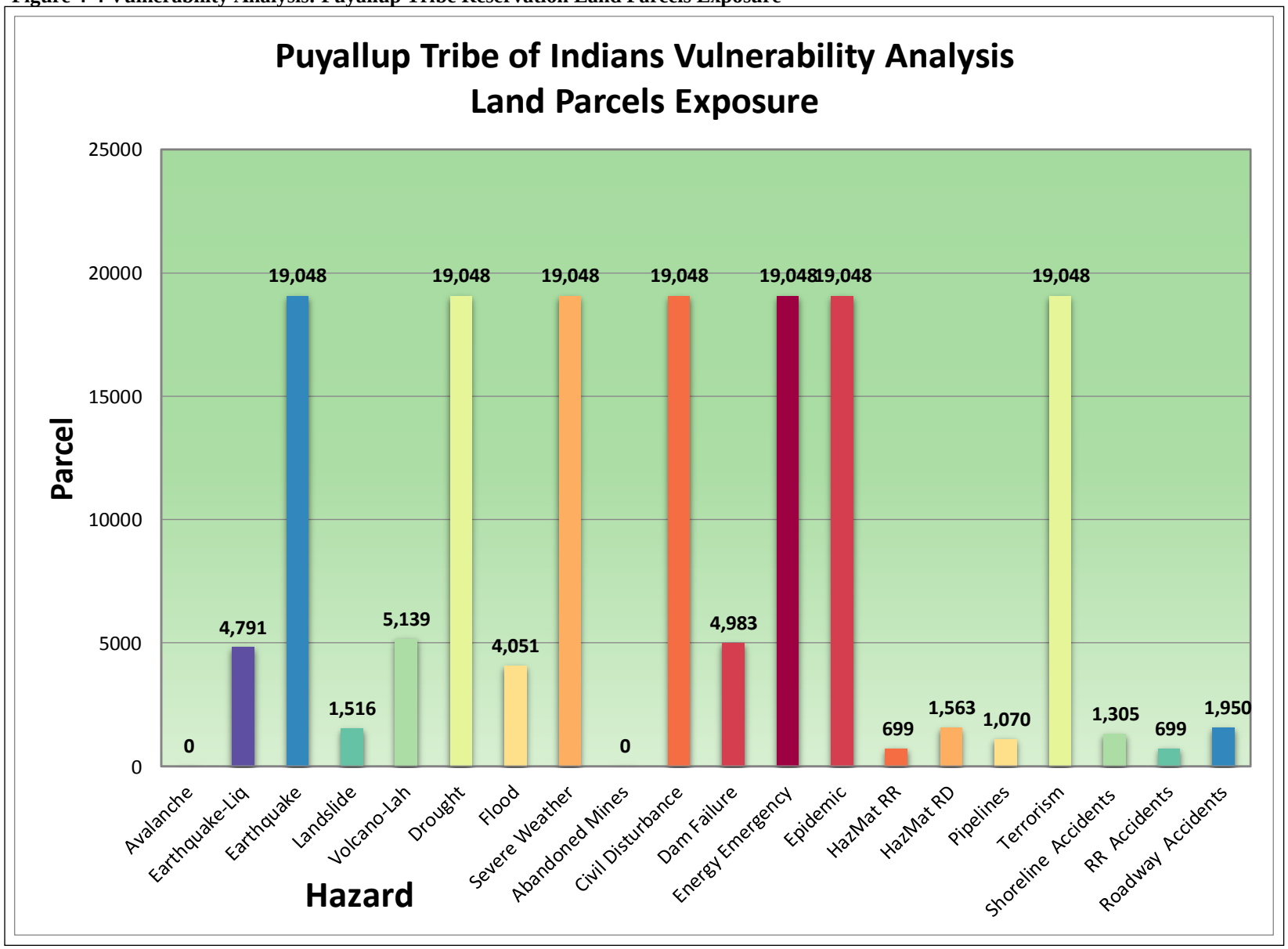


Figure 4-4 Vulnerability Analysis: Puyallup Tribe Reservation Land Parcels Exposure



Housing Information

All homes, businesses and infrastructure are exposed to or vulnerable to severe weather and earthquake ground shaking. Those which are located along the Puyallup River are at a higher risk for liquefaction due to an earthquake due to the type of soils along the river.

Table 4-4 Vulnerability Analysis: Population Exposure

THREAT[2]			POPULATION			SPECIAL POPULATIONS (OF TOTAL EXPOSED POPULATION)			
			Total	% Base	Density (pop/sq mi)	65+ yrs		20- yrs	
						#	%	#	%
RESERVATION BASE (R)			**46,605**	**100%**	**1,912.15**	**4,474**	**9.6%**	**13,571**	**29.1%**
TRIBAL TRUST BASE (PTI)			**11,582**	**100%**	**3,244.07**	**1,303**	**11.3%**	**3,056**	**26.4%**
Geological	**Avalanche**	R	NA	NA	NA	NA	NA	NA	NA
		PTI	NA	NA	NA	NA	NA	NA	NA
	Earthquake Liquefaction Potential	R	12,054	25.9%	1,016	1,141	2.4%	3,098	6.6%
		PTI	5,095	44.0%	3,825	703	6.1%	1,110	9.6%
	Landslide	R	10,797	23.2%	2,956	1,341	2.9%	2,735	5.9%
		PTI	2,488	21.5%	1,573	355	3.1%	550	4.7%
	Tsunami (based on Seattle Fault)	R	5,161	11.1%NA	843	443	10%	1,419	3.0%
		PTI	1,622	14.0%	2,755	260	2.2%	346	3.0%
	Volcanic	R	13,110	28.1%	950	1,214	2.6%	3,441	7.4%
		PTI	5,029	43.4%	2,821	43	0.4%	120	1.0%
Meteorological	**Drought**	R	46,605	100%	1,912.15	4,474	6%	13,571	29.1%
		PTI	7,948	100%	3,663.21	758	9.5%	2,178	27.4%
	Flood	R	9,362	20.1%	1,072.21	903	1.9%	2,482	5.3%
		PTI	3,883	33.5%	3,662.78	526	4.5%	912	7.9%
	Severe Weather	R	46,605	100%	1,912.15	4,474	6%	13,571	29.1%
		PTI	7,948	100%	3,663.21	758	9.5%	2,178	27.4%

	WUI Fire	R	NA	NA	NA	NA	NA	NA	NA
		PTI	NA	NA	NA	NA	NA	NA	NA
Technological	**Abandoned Mines**	R	0	0	0	0	0	0	0
		PTI	0	0	0	0	0	0	0
	Civil Disturbance	R	46,605	100%	1,912.15	4,474	6%	13,571	29.1%
		PTI	7,948	100%	3,663.21	758	9.5%	2,178	27.4%
	Dam Failure Inundation	R	12,569	27.0%	1,013.70	1,177	2.5%	3,278	24.2%
		PTI	4,861	42.0%	4,398.29	672	5.8%	1,060	9.2%
	Energy Emergency	R	46,605	100%	1,912.15	4,474	6%	13,571	29.1%
		PTI	7,948	100%	3,663.21	758	9.5%	2,178	27.4%
	Epidemic	R	46,605	100%	1,912.15	4,474	6%	13,571	29.1%
		PTI	7,948	100%	3,663.21	758	9.5%	2,178	27.4%
	Hazardous Material Railroad	R	1,196	2.6%	831.94	61	0.1%	330	0.7%
		PTI	417	3.6%	2,818.46	32	0.3%	104	0.9%
	Hazardous Material Roads	R	3,708	8.0%	1,485.21	416	9.3%	860	1.8%
		PTI	1,294	11.2%	3,315.29	88	0.8%	329	2.8%
	Pipeline Hazard	R	6,218	13.3%	1,517.54	720	1.5%	1,461	3.1%
		PTI	2,926	25.3%	34,636.83	432	3.73%	614	30.0%
	Terrorism	R	46,605	100%	1,912.15	4,474	6%	13,571	29.1%
		PTI	7,948	100%	3,663.21	758	9.5%	2,178	27.4%
Technological	**Transportation Accidents - Shoreline**	R	2,705	5.8%	1,887	373	.8%	628	1.3%
		PTI	1,182	10.2%	16,821.98	105	0.2%	321	.7%
	Transportation Accidents - Railroad	R	1,196	2.6%	33,640.85	61	0.1%	330	.7%
		PTI	417	3.6%	50,462.84	32	2.5%	104	.9%

	Transportation Accidents - Roads	R	3,708	8.0%	84,103.69	416	.9%	860	1.8%
		PTI	1,294	11.2%	3,315.29	88	0.8%	329	2.8%

Figure 4-5 Vulnerability Analysis: Puyallup Tribe Reservation Population Exposure

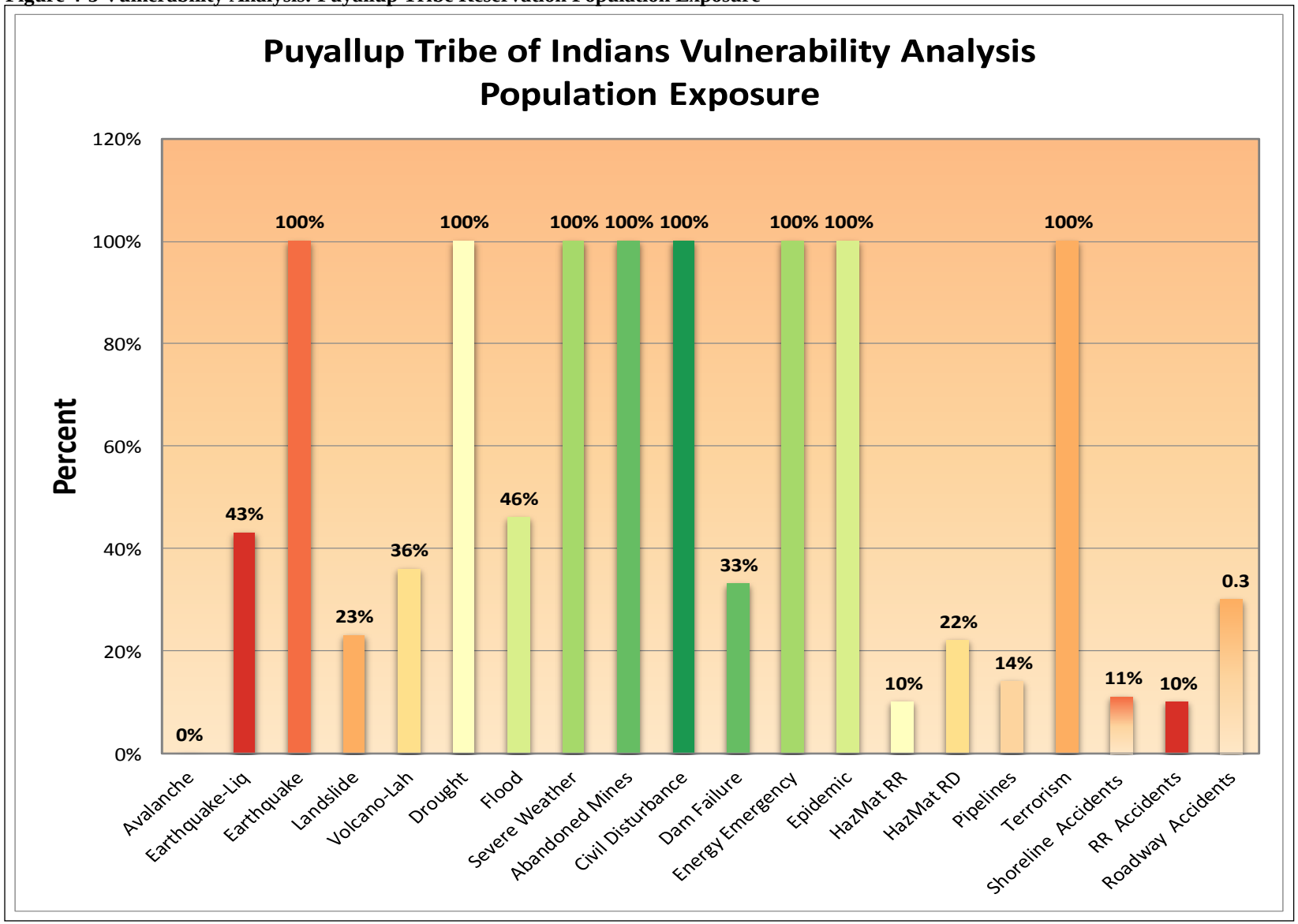


Table 4-5 Vulnerability Analysis: General Infrastructure Exposure

THREAT[2]			LAND VALUE			IMPROVED VALUE			TOTAL ASSESSED VALUE		
			Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)
RESERVATION BASE (R)			**$3,395,874,100**	**100%**	**$178,280**	**$4,620,998,900**	**100%**	**$242,598**	**$8,016,873,000**	**100%**	**$420,878**
TRIBAL TRUST BASE (PTI)			**$180,592,400**	**100%**	**$372,355**	**$119,736,800**	**100%**	**$246,880**	**$300,329,200**	**100%**	**$19,235**
Geological	**Avalanche**	R	NA	NA	NA	NA	NA	NA	NA	NA	NA
		PTI	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Earthquake Liquefaction Potential	R	1,940,416,400	57.1%	405,013	2,108,575,300	46.5%	440,112	4,048,991,700	50.5%	845,125
		PTI	136,736,200	75.7%	844,051	95,165,800	79.5%	587,443	231,902,000	77.2%	1,431,494
	Landslide	R	212,797,000	6.3%	140,367	242,479,700	5.2%	159,947	455,276,700	5.7%	300,314
		PTI	4,627,800	2.6%	220,371	3,670,400	3.1%	174,781	8,298,200	2.8%	354,925
	Tsunami (based on Seattle Fault)	R	1,309,607,400	38.6%	647,359	1,182,814,500	25.6%	584,683	2,492,421,900	31.1%	1,232,042
		PTI	107,247,100	59.4%	1,128,917	63,306,500	52.9%	666,384	170,553,600	56.8%	1,795,301
	Volcanic	R	2,079,428,400	61.2%	379,112	2,198,679,000	47.6%	400,853	4,278,107,400	53.4%	779,965
		PTI	153,390,600	84.9%	829,138	99,359,800	83.0%	537,080	252,750,400	84.2%	1,366,218

Meteorological	**Drought**	R	3,395,874,100	100%	178,280	4,620,998,900	100%	242,598	8,016,873,000	100%	420,878
		PTI	180,592,400	100.0%	372,355	119,736,800	100.0%	246,880	300,329,200	100.0%	619,235
	Flood	R	1,211,336,100	35.7%	299,022	1,488,539,100	32.2%	367,450	2,699,875,200	33.7%	666,472
		PTI	77,756,100	43.1%	518,374	90,066,400	75.2%	600,443	167,822,500	55.9%	1,118,817
	Severe Weather	R	3,395,874,100	100%	178,280	4,620,998,900	100%	242,598	8,016,873,000	100%	420,878
		PTI	180,592,400	100.0%	372,355	119,736,800	100.0%	246,880	300,329,200	100.0%	619,235
	WUI Fire	R	NA	NA	NA	NA	NA	NA	NA	NA	NA
		PTI	NA	NA	NA	NA	NA	NA	NA	NA	NA
Technological	**Abandoned Mines**	R	0	0	0	0	0	0	0	0	0
		PTI	0	0	0	0	0	0	0	0	0
	Civil Disturbance	R	3,395,874,100	100%	178,280	4,620,998,900	100%	242,598	8,016,873,000	100%	420,878
		PTI	180,592,400	100.0%	372,355	119,736,800	100.0%	246,880	300,329,200	100.0%	619,235
	Dam Failure	R	1,981,539,000	58.4%	397,660	2,128,684,800	46.1%	427,189	4,110,223,800	51.3%	824,849
		PTI	137,761,500	76.3%	815,157	96,515,400	80.6%	571,097	234,276,900	78.0%	1,386,254
	Energy Emergency	R	3,395,874,100	100%	178,280	4,620,998,900	100%	242,598	8,016,873,000	100%	420,878
		PTI	180,592,400	100.0%	372,355	119,736,800	100.0%	246,880	300,329,200	100.0%	619,235
	Epidemic	R	3,395,874,100	100%	178,280	4,620,998,900	100%	242,598	8,016,873,000	100%	420,878

		PTI	180,592,400	100.0%	372,355	119,736,800	100.0%	246,880	300,329,200	100.0%	619,235
Technological	**Hazardous Material Railroad**	R	136,547,700	4.0%	195,347	188,974,800	4.1%	270,350	379,182,705	4.7%	451,946
		PTI	10,694,300	5.9%	314,538	1,068,400	0.9%	31,424	11,762,700	3.9%	345,962
	Hazardous Material Roads	R	520,760,500	15.3%	333,180	529,935,400	11.5%	339,050	379,182,705	4.7%	451,946
		PTI	52,187,600	28.9%	375,450	59,836,800	50.0%	430,480	112,024,400	37.3%	805,930
	Pipeline Hazard	R	528,278,400	15.6%	493718	527,636,600	11.4%	493,118	1,055,915,000	13.2%	986,836
		PTI	7,309,100	4.0%	235,777	2,534,300	2.1%	81,752	9,843,400	3.3%	317,529
	Terrorism	R	3,395,874,100	100%	178,280	4,620,998,900	100%	242,598	8,016,873,000	100%	420,878
		PTI	180,592,400	100.0%	372,355	119,736,800	100.0%	246,880	300,329,200	100.0%	619,235
	Transportation Accidents - Shoreline	R	550,218,300	16.2%	791,707	332,775,100	7.2%	481,481	951,122,100	11.9%	947,035
		PTI	43,883,100	1.3%	1,781,273	6,675,600	5.6%	254,043	50,558,700	0.6%	2,035,316
	Transportation Accidents - Railroad	R	136,547,700	4.0%	195,347	188,974,800	4.1%	270,350	379,182,705	4.7%	451,946
		PTI	10,694,300	5.9%	314,538	1,068,400	0.9%	31,424	11,762,700	3.9%	345,962
	Transportation Accidents - Roads	R	520,760,500	15.3%	333,180	529,935,400	11.5%	339,050	379,182,705	4.7%	451,946
		PTI	52,187,600	28.9%	375,450	59,836,800	50.0%	430,480	112,024,400	37.3%	805,930

Table 4-6a Vulnerability Summary Analysis: General Exposure 2017

THREAT[30]		AREA (SQ MI)		PARCELS	
		Total	% Base	Total	% Base
RESERVATION BASE (R)		**24.37**	**100%**	**19,048**	**100%**
TRIBAL TRUST BASE (PTI)		**3.57**	**100%**	**485**	**100%**
Earthquake Liquefaction Potential	R	11.86	48.7%	4,791	25.2%
	PTI	1.33	37.3%	162	33.4%
Volcanic (lahar)	R	13.79	56.6%	5,485	28.8%
	PTI	1.78	49.9%	185	38.1%
Flood	R	8.73	35.8%	4,051	21.3%
	PTI	1.06	29.7%	150	30.9%

Table 4-6b Vulnerability Summary Analysis: General Exposure 2013

THREAT[31]		AREA (SQ MI)		PARCELS	
		Total	% Base	Total	% Base
RESERVATION BASE (R)		**28.89**	**100%**	**18,534**	**100%**
TRIBAL TRUST BASE (PTI)		**2.17**	**100%**	**393**	**100%**
Earthquake Liquefaction Potential	R	14.17	49%	5,261	28.4%
	PTI	1.46	67.3%	145	36.9%
Volcanic (lahar)	R	14.20	49.1%	5,772	31.1%
	PTI	1.50	69%	314	79.9%
Flood	R	14.15	49%	4,617	24.9%
	PTI	2.03	93.4%	152	38.7%

Table 4-7a Vulnerability Summary Analysis: Population Exposure 2017

THREAT[32]		POPULATION			SPECIAL POPULATIONS (OF TOTAL EXPOSED POPULATION)			
		Total	% Base	Density (pop/sq mi)	65+ yrs		20- yrs	
					#	%	#	%
RESERVATION BASE (R)		**46,605**	**100%**	**1,912.15**	**4,474**	**9.6%**	**13,571**	**29.1%**
TRIBAL TRUST BASE (PTI)		**11,582**	**100%**	**3,244.07**	**1,303**	**11.3%**	**3,056**	**26.4%**
Earthquake Liquefaction Potential	R	12,054	25.9%	1,016	1,141		2.4%	
	PTI	5,095	44.0%	3,825	703		6.1%	
Volcanic (lahar)	R	13,110	28.1%	950	1,214		2.6%	
	PTI	5,029	43.4%	2,821	43		0.4%	
Flood	R	9,362	20.1%	1,072.21	903		1.9%	
	PTI	3,883	33.5%	3,662.78	526		4.5%	

Table 4-7b Vulnerability Summary Analysis: General Exposure 2013

THREAT[33]		POPULATION			SPECIAL POPULATIONS (OF TOTAL EXPOSED POPULATION)			
		Total	% Base	Density (pop/sq mi)	65+ yrs		18- yrs	
					#	%	#	%
RESERVATION BASE (R)		**41,226**	**100%**	**1,426.75**	**3,303**	**8%**	**11,950**	**29%**
TRIBAL TRUST BASE (PTI)		**7,948**	**100%**	**3,663.21**	**758**	**9.5%**	**2,178**	**27.4%**
Earthquake Liquefaction Potential	R	17,878	43.4%	1,261.81	1,787		4.3%	
	PTI	447	5.6%	305.90	43		0.5%	
Volcanic (lahar)	R	15,178	36.8%	1,069.17	1,621		3.9%	
	PTI	447	5.6%	298.60	43		0.5%	
Flood	R	19,268	46.7%	1,361.48	1,891		4.6%	
	PTI	438	5.5%	216.03	43		0.5%	

Table 4-8a Vulnerability Summary Analysis: Infrastructure Exposure 2017

THREAT[34]		LAND VALUE			IMPROVED VALUE			TOTAL ASSESSED VALUE		
		Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)
RESERVATION BASE (R)		**$3,395,874,100**	**100%**	**$178,280**	**$4,620,998,900**	**100%**	**$242,598**	**$8,016,873,000**	**100%**	**$420,878**
TRIBAL TRUST BASE (PTI)		**$180,592,400**	**100%**	**$372,355**	**$119,736,800**	**100%**	**$246,880**	**$300,329,200**	**100%**	**$19,235**
Earthquake Liquefaction Potential	R	1,940,416,400	57.1%	405,013	2,108,575,300	46.5%	440,112	4,048,991,700	50.5%	845,125
	PTI	136,736,200	75.7%	844,051	95,165,800	79.5%	587,443	231,902,000	77.2%	1,431,494
Volcanic (lahar)	R	2,079,428,400	61.2%	379,112	2,198,679,000	47.6%	400,853	4,278,107,400	53.4%	779,965
	PTI	153,390,600	84.9%	829,138	99,359,800	83.0%	537,080	252,750,400	84.2%	1,366,218
Flood	R	1,211,336,100	35.7%	299,022	1,488,539,100	32.2%	367,450	2,699,875,200	33.7%	666,472
	PTI	77,756,100	43.1%	518,374	90,066,400	75.2%	600,443	167,822,500	55.9%	1,118,817

Table 4-8b Vulnerability Summary Analysis: Infrastructure Exposure 2013

THREAT[35]		LAND VALUE			IMPROVED VALUE			TOTAL ASSESSED VALUE		
		Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)	Total ($)	% Base	Avg. Value ($)
RESERVATION BASE (R)		**$3,811,660,800**	**100%**	**$205,769**	**$3,583,100,475**	**100%**	**193,441**	**$7,394,761,275**	**100%**	**$399,209**
TRIBAL TRUST BASE (PTI)		**$179,968,600**	**100%**	**$457,935**	**$77,844,900**	**100%**	**$198,079**	**$257,813,500**	**100%**	**$656,014**
Earthquake Liquefaction Potential	R	2,375,734,200	62.3%	450,376	1,742,262,075	48.6%	330,349	4,117,996,275	55.7%	780,725
	PTI	154,744,500	86%	1,067,203	60,870,200	78.2%	419,794	215,614,700	83.6%	1,486,998
Volcanic (lahar)	R	2,407,645,500	63.2%	416,116	1,765,580,975	49.3%	305,200	4,173,226,475	56.4%	721,316
	PTI	159,878,400	88.8%	509,167	70,650,100	78.2%	225,000	230,528,500	83.6%	734,167
Flood	R	2,226,077,300	58.4%	480,172	1,544,480,100	43.1%	333,221	3,770,557,400	51%	813,393
	PTI	158,283,500	88%	1,041,339	61,030,500	78.4%	401,516	219,314,000	85.1%	1,442,855

Table 4-9a Consequence Analysis Chart – Geological[36,37]

THREAT[2]		CONSEQUENCE	YES OR NO
Geological	**Avalanche**	Impact to the Public	No
		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	No
		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
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Landslide	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	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	Yes
		Impact to Property, Facilities and Infrastructure	Yes
		Impact to the Environment	Yes
		Impact to the Jurisdiction Economic Condition	Yes
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Volcanic[38]	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
		Impact to Reputation or Confidence in Jurisdiction	Yes

Table 4-9b 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	Yes
		Impact to Reputation or Confidence in Jurisdiction	No
	Flood	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
		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
		Impact to Reputation or Confidence in Jurisdiction	No
	WUI Fire	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
		Impact to Reputation or Confidence in Jurisdiction	Yes

Table 4-9c Consequence Analysis Chart – Technological[39]

THREAT		CONSEQUENCE	YES OR NO
Technological	**Abandoned Mines**	Impact to the Public	No
		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	No
		Impact to the Jurisdiction Economic Condition	No
		Impact to Reputation or Confidence in Jurisdiction	No
	Civil Disturbance	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	No
		Impact to the Jurisdiction Economic Condition	Yes
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Dam Failure	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
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Energy Emergency	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	No
		Impact to the Jurisdiction Economic Condition	Yes
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Epidemic	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	No
		Impact to the Environment	No
		Impact to the Jurisdiction Economic Condition	Yes
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Hazardous Materials	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
		Impact to Reputation or Confidence in Jurisdiction	No
	Pipeline Hazards	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
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Terrorism	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
		Impact to Reputation or Confidence in Jurisdiction	Yes
	Transportation Accident	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
		Impact to Reputation or Confidence in Jurisdiction	Yes

Endnotes

[1] 2015 Pierce County HIRA Abandoned Mines Recurrence Rate
[2] 2015 Pierce County HIRA Civil Disturbance Recurrence Rate
[3] 2015 Pierce County HIRA Civil Disturbance Recurrence Rate
[4] 2015 Pierce County HIRA Dam Failure Recurrence Rate
[5] 2015 Pierce County HIRA Energy Emergencies Recurrence
[6] 2015 Pierce County HIRA Epidemic Recurrence Rate
[7] 2009 Pierce County HIRA Hazardous Materials Recurrence Rate
[8] 2015 Pierce County HIRA Pipeline Hazards
[9] 2015 Pierce County HIRA Terrorism Hazards
[10] 2015 Pierce County HIRA Transportation Hazards
[11] Info obtained from the Pierce County GIS application, CountyView Pro (10/16).
[12] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.
[13] Sq mi is based from the Pierce County GIS application, County View Pro (10/16) on Tribal boundary to include all that exists within in, water, roads, railroads etc.
[14] Tax parcels are based from the Pierce County GIS application, County View Pro (10/16) and are all tax parcels within the Tribal boundary.
[15] Tribal planning area is not vulnerable to this hazard, therefore it is marked NA or non-applicable.
[16] It should be noted here that although all residents, all property and all infrastructure of the Tribal Trust Lands are vulnerable to earthquake shaking, not all are subject to the affects of liquefaction and liquefiable soils which is what is represented here.
[17] The threat of volcanic ashfall affects the entire Region 5 however some jurisdictions are specifically threatened by lahar flows directly from Mt. Rainier; an active volcano.
[18] The entire Reservation and Trust Lands are vulnerable to drought. There are three things that must be understood about the affect of drought on the planning area: 1) Drought is a Region wide event. When it does affect Pierce County, it will affect every jurisdiction, 2) Drought will gradually develop over time. It is a gradually escalating emergency that may take from months to years to affect the jurisdiction. Initially lack of water may not even be noticed by the citizens. However, as the drought continues, its effects will be noticed by a continually expanding portion of the community until it is felt by all, and 3) Jurisdictions will be affected differently at different times as a drought develops. This will vary depending on the needs of each local jurisdiction. Some examples are: jurisdictions that have industry that requires a continuous supply of a large quantity of water; others have agriculture that requires water, but might only require water at certain times of the year; and, some jurisdictions have a backup source of water while others do not.
[19] According to the most recent information from the Department of Natural Resources, the Tribal Trust Lands while undergoing development do not have large areas of forested land that could develop into a wildland/urban interface fire. Further study is needed to determine the extent of the area that could be affected.
[20] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades

to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[21] The definition of Abandoned Mines comes from the 2015 Pierce County HIRA: Abandoned mines are any excavation under the surface of the earth, formerly used to extract metallic ores, coal, or other minerals, and that are no longer in production.

[22] The definition of Civil Disturbance comes from the 2015 Pierce County HIRA: Civil Disturbance (unrest) is the result of groups or individuals within the population feeling, rightly or wrongly, that their needs or rights are not being met, either by the society at large, a segment thereof, or the current overriding political system. When this results in community disruption of a nature where intervention is required to maintain public safety it has become a civil disturbance. Additionally, the Region 5 Strategic Plan includes Operational Objectives 3 & 4: Intelligence Gathering, Indicators, Warnings, etc; and Intelligence and Information Sharing.

[23] The definition of Dam Failure comes from the 2015 Pierce County HIRA: A dam is any "barrier built across a watercourse for impounding water.[23]" Dam failures are catastrophic events "characterized by the sudden, rapid, and uncontrolled release of impounded water. The vulnerability analysis was based on the potential dam failure from Mud Mountain Dam and Lake Tapps using Pierce County's GIS data which originated from each of the dams emergency plans inundation maps.

[24] The definition of an Energy Emergency comes from the 2015 Pierce County HIRA: Energy emergency refers to an out-of-the-ordinary disruption, or shortage, of an energy resource for a lengthy period of time. Additionally the Region 5 Strategic Plan addresses Energy Emergencies in its Operational Objective 32, Restoration of Lifelines which addresses the restoration of critical services such as oil, gas, natural gas, electric, etc.

[25] The definition of epidemic comes from the TPCHD Flu Plan of 2005: A Pandemic is an epidemic occurring over a very wide area and usually affecting a large proportion of the population. Pandemics occur when a wholly new subtype of influenza A-virus emerges. A "novel" virus can develop when a virulent flu strain that normally infects birds or animals infects a human who has influenza; the two viruses can exchange genetic material, creating a new, virulent flu virus that can be spread easily from person-to-person. Unlike the flu we see yearly, no one would be immune to this new flu virus, which would spread quickly, resulting in widespread epidemic disease – a pandemic. (DOH Plan & U.S. Dept. of HHS).

[26] The definition of Hazardous Materials comes from the 2015 Pierce County HIRA: Hazardous materials are materials, which because of their chemical, physical or biological properties, pose a potential risk to life, health, the environment, or property when not properly contained. A hazardous materials release then is the release of the material from its container into the local environment. A general rule of thumb for safety from exposure to hazardous material releases is 1000ft; the Emergency Response Guidebook 2008, established by the US Dept of Transportation, contains advice per specific materials. The vulnerability analysis was broken into two sub sections for a better understanding of the hazard using Pierce County's GIS data with a 500 foot buffer on either side of the railroads and major roadways.

[27] The definition of Pipeline Emergency comes from the 2015 Pierce County HIRA: While there are many different substances transported through pipelines including sewage, water and even beer, pipelines, for the purpose of this chapter, are transportation arteries carrying liquid and gaseous fuels. They may be buried or above ground.

[28] The definition of Terrorism comes from the 2015 Pierce County HIRA: Terrorism has been defined by the Federal Bureau of Investigation as, "the unlawful use of force or violence against persons or property to intimidate or coerce a Government, the civilian population or any segment thereof, in furtherance of political or social objectives." These acts can vary considerably in their scope, from cross burnings and the spray painting of hate messages to the destruction of civilian targets. In some cases, violence in the schools has also been labeled as a form of terrorism.

[29] The definition of Transportation Accident comes from the 2015 Pierce County HIRA: Transportation accidents as used in this assessment include accidents involving a method of transportation on the road, rail, air, and maritime systems within the confines of Pierce County. The vulnerability analysis was broken into three sub sections for a better understanding of the hazard using Pierce County's GIS data; Commencement Bay to include inland rivers and

streams, railroads, and roads. A 200 foot buffer was applied to all the shorelines and a 500 foot buffer on either side of the railroads and roadways.

[30] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[31] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[32] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[33] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[34] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as

unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[35] Currently the expanding body of empirical data on climate change supports its basic premise that the long term average temperature of the earth's atmosphere has been increasing for decades *(1850 to 2008)*. This trend is continuing and will create dramatic changes in the local environment of Pierce County. Today, questions revolve around the overall increase in local temperature and its long term effects. Climate change today refers to variations in either regional or global environments over time. Time can refer to periods ranging in length from a few decades to other periods covering millions of years. A number of circumstances can cause climate change. Included herein are such diverse factors as solar cycles, volcanic eruptions, changing ocean current patterns, or even something as unusual as a methane release from the ocean floor. Over the past 150 years good temperature records have allowed comparisons to be made of global temperatures from year-to-year. This has shown an overall increase of approximately 0.7° C during this period. An increasing body of scientific evidence implies that the primary impetus driving climate change today is an increase in atmospheric green house gases.

[36] In the Impact to Property, Facilities and Infrastructure, both Tables 4-5a and 4-5b, look at the impact to all property, facilities and infrastructure existing in the jurisdiction, not just to that owned by the jurisdiction.

[37] The consideration for each of these hazards, in both Tables 4-5a and 4-5b, as to whether an individual hazard consequence 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 consequence will have a major impact, not that there will be no impact at all.

[38] 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. Most jurisdictions 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.

[39] The Technological Consequences are added herein to acknowledge the role of human-caused hazards in the health and safety of unincorporated Pierce County. The consequences noted are under the same criteria as natural hazards given their impacts to the departmental assets.

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