

**Scenario: M 6.8 Boulder Creek Fault  
Clallam County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Educational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Clallam</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.  
 Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.  
 Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.  
 Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	159	0	0	0	0	159
Commercial	1694	1	0	0	0	1,695
Education	64	0	0	0	0	64
Government	49	0	0	0	0	49
Industrial	555	0	0	0	0	555
Religion	120	0	0	0	0	120
Other Residential	9829	14	1	0	0	9,844
Single Family	21,819	1	0	0	0	21,820

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$8,000	\$107,000	\$64,000	\$2,000	0	\$2,000	\$2,000	\$2,000	\$3,000	\$190,000

**Hospital Functionality**

	At Day 1			At day 3		At day 7		At day 30		At day 90	
	Total Number of Beds	Number of Beds	%								
Large											
Medium	178	178	100	178	100	178	100	178	100	178	100
Small											
<b>Total</b>	<b>178</b>	<b>178</b>	<b>—</b>								

Large Hospital: > 150 beds  
 Medium Hospital: 50-150 beds  
 Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
95	95	0	0	0	0

**Scenario: M 6.8 Boulder Creek Fault  
Clallam County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
0	0	\$0

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
28,764	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
28,764	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
0	0	0	0

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
0	0

**Essential Facilities Functionality**

	Count	Functionality (%)
	At Day 1	
Emergency Operation Center	2	100
Fire Station Facilities	21	100
Police Station Facilities	5	100
School	34	100

**Scenario: M 6.8 Boulder Creek Fault  
Island County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Educational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Island</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.

Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.

Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.

Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	132	1	0	0	0	133
Commercial	1343	8	1	0	0	1,352
Education	59	0	0	0	0	59
Government	40	0	0	0	0	40
Industrial	502	3	0	0	0	505
Religion	88	0	0	0	0	88
Other Residential	6340	64	4	0	0	6,408
Single Family	25,049	17	0	0	0	25,066

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$70,000	\$810,000	\$423,000	\$10,000	0.01	\$20,000	\$15,000	\$18,000	\$23,000	\$1,388,000

**Hospital Functionality**

	At Day 1			At day 3		At day 7		At day 30		At day 90	
	Total Number of Beds	Number of Beds	%								
Large											
Medium	51	51	100	51	100	51	100	51	100	51	100
Small	26	26	100	26	100	26	100	26	100	26	100
<b>Total</b>	<b>77</b>	<b>77</b>	<b>—</b>								

Large Hospital: > 150 beds

Medium Hospital: 50-150 beds

Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
6	6	0	0	0	0

**Scenario: M 6.8 Boulder Creek Fault  
Island County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
0	0	\$0

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
30,319	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
30,319	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
0	0	0	0

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
0	0

**Essential Facilities Functionality**

	Count	Functionality (%)
		At Day 1
Emergency Operation Center	1	100
Fire Station Facilities	26	100
Police Station Facilities	4	100
School	32	100

**Scenario: M 6.8 Boulder Creek Fault  
King County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Educational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total King</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.  
 Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.  
 Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.  
 Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	1,920	0	0	0	0	1,920
Commercial	37,113	0	0	0	0	37,113
Education	1,342	0	0	0	0	1,342
Government	555	0	0	0	0	555
Industrial	9,944	0	0	0	0	9,944
Religion	2,330	0	0	0	0	2,330
Other Residential	85,900	0	0	0	0	85,900
Single Family	448,571	0	0	0	0	448,571

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$0	\$0	\$0	\$0	0	\$0	\$0	\$0	\$0	\$000

**Hospital Functionality**

	At Day 1			At day 3		At day 7		At day 30		At day 90	
	Total Number of Beds	Number of Beds	%								
Large	4,943	4,943	100	4,943	100	4,943	100	4,943	100	4,943	100
Medium	684	684	100	684	100	684	100	684	100	684	100
Small	100	100	100	100	100	100	100	100	100	100	100
<b>Total</b>	<b>5,727</b>	<b>5,727</b>	<b>—</b>								

Large Hospital: > 150 beds  
 Medium Hospital: 50-150 beds  
 Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
1,033	1,033	0	0	0	0

**Scenario: M 6.8 Boulder Creek Fault  
King County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
0	0	\$0

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
745,853	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
745,853	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
0	0	0	0

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
0	0

**Essential Facilities Functionality**

	Count	Functionality (%)
	At Day 1	
Emergency Operation Center	18	100
Fire Station Facilities	164	100
Police Station Facilities	52	100
School	721	100

**Scenario: M 6.8 Boulder Creek Fault  
San Juan County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Educational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total San Juan</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.

Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.

Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.

Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	71	0	0	0	0	71
Commercial	508	2	0	0	0	510
Education	24	0	0	0	0	24
Government	29	0	0	0	0	29
Industrial	227	1	0	0	0	228
Religion	37	0	0	0	0	37
Other Residential	1,864	14	1	0	0	1,879
Single Family	8,083	4	0	0	0	8,087

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$13,000	\$138,000	\$71,000	\$3,000	0.01	\$3,000	\$4,000	\$4,000	\$5,000	\$240,000

**Hospital Functionality (There are no hospitals for San Juan County in the HAZUS database.)**

	Total Number of Beds	At Day 1		At day 3		At day 7		At day 30		At day 90	
		Number of Beds	%								
Large											
Medium											
Small											
<b>Total</b>	<b>0</b>	<b>0</b>	<b>—</b>								

Large Hospital: > 150 beds

Medium Hospital: 50-150 beds

Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
9	9	0	0	0	0

**Scenario: M 6.8 Boulder Creek Fault  
San Juan County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
0	0	\$0

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
7,076	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
7,076	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
0	0	0	0

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
0	0

**Essential Facilities Functionality**

	Count	Functionality (%)
	At Day 1	
Emergency Operation Center	1	100
Fire Station Facilities	16	100
Police Station Facilities	1	100
School	16	100

**Scenario: M 6.8 Boulder Creek Fault  
Skagit County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
Educational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other-Residential	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
Single Family	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
<b>Total Skagit</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>2</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.  
 Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.  
 Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.  
 Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	315	12	3	0	0	330
Commercial	2,404	107	19	0	0	2,530
Education	77	3	0	0	0	80
Government	50	2	0	0	0	52
Industrial	805	38	9	0	0	852
Religion	168	5	1	0	0	174
Other Residential	10,655	699	144	2	0	11,500
Single Family	30,462	353	3	0	0	30,818

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$1,407,000	\$9,316,000	\$4,843,000	\$260,000	0.13	\$619,000	\$334,000	\$397,000	\$429,000	\$17,605,000

**Hospital Functionality**

	At Day 1			At day 3		At day 7		At day 30		At day 90	
	Total Number of Beds	Number of Beds	%								
Large	159	158	100	158	100	159	100	159	100	159	100
Medium											
Small	78	78	100	78	100	78	100	78	100	78	100
<b>Total</b>	<b>237</b>	<b>236</b>	<b>—</b>	<b>236</b>	<b>—</b>	<b>237</b>	<b>—</b>	<b>237</b>	<b>—</b>	<b>237</b>	<b>—</b>

Large Hospital: > 150 beds  
 Medium Hospital: 50-150 beds  
 Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
212 (210*)	208	2	0	0	0

\* values in parentheses include rounding error.

**Scenario: M 6.8 Boulder Creek Fault  
Skagit County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
3	129	\$8,368,000

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
42,003	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
42,003	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
2,000	1,000	3,000	120

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
1	0

**Essential Facilities Functionality**

	Count	Functionality (%)
		At Day 1
Emergency Operation Center	1	99
Fire Station Facilities	37	99
Police Station Facilities	9	99
School	59	99

**Scenario: M 6.8 Boulder Creek Fault  
Snohomish County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Educational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Total Snohomish</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.

Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.

Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.

Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	829	1	0	0	0	830
Commercial	9,934	20	2	0	0	9,956
Education	343	0	0	0	0	343
Government	195	0	0	0	0	195
Industrial	3,754	8	1	0	0	3,763
Religion	652	1	0	0	0	653
Other Residential	35,512	134	8	0	0	35,654
Single Family	155,543	26	0	0	0	155,569

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$160,000	\$1,703,000	\$917,000	\$42,000	0	\$46,000	\$38,000	\$44,000	\$57,000	\$3,006,000

**Hospital Functionality**

	Total Number of Beds	At Day 1		At day 3		At day 7		At day 30		At day 90	
		Number of Beds	%								
Large	738	738	100	738	100	738	100	78	100	738	100
Medium	72	72	100	72	100	72	100	72	100	72	100
Small	48	48	100	48	100	48	100	48	100	48	100
<b>Total</b>	<b>858</b>	<b>858</b>	<b>—</b>	<b>858</b>	<b>—</b>	<b>858</b>	<b>—</b>	<b>198</b>	<b>—</b>	<b>858</b>	<b>—</b>

Large Hospital: > 150 beds

Medium Hospital: 50-150 beds

Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
466	466	0	0	0	0

**Scenario: M 6.8 Boulder Creek Fault  
Snohomish County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
1	1	\$37,000

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
245,054	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
245,054	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
0	0	0	0

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
0	0

**Essential Facilities Functionality**

	Count	Functionality (%)
		At Day 1
Emergency Operation Center	3	100
Fire Station Facilities	75	100
Police Station Facilities	23	100
School	248	100

**Scenario: M 6.8 Boulder Creek Fault  
Whatcom County**

**Casualties Summary Report**

	Injury Severity Level														
	Severity 1			Severity 2			Severity 3			Severity 4			Total		
	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM	2:00 AM	2:00 PM	5:00 PM
Commuting	0	0	1	0	0	2	0	0	2	0	0	0	0	0	5
Commercial	0	6	5	0	0	0	0	0	0	0	0	0	0	6	5
Educational	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0
Hotels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
Other-Residential	7	1	2	1	0	0	0	0	0	0	0	0	8	1	2
Single Family	4	1	1	0	0	0	0	0	0	0	0	0	4	1	1
<b>Total Whatcom</b>	<b>11</b>	<b>11</b>	<b>10</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>11</b>	<b>14</b>

Severity Level 1: Injuries will require medical attention but hospitalization is not needed.

Severity Level 2: Injuries will require hospitalization but are not considered life-threatening.

Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.

Severity Level 4: Victims are killed by the earthquake

**Number of Buildings Damaged by General Occupancy Class**

	Number of Buildings					
	None	Slight	Moderate	Extensive	Complete	Total
Agriculture	433	55	20	3	0	511
Commercial	3,636	382	114	10	0	4,142
Education	156	12	4	0	0	172
Government	75	7	2	0	0	84
Industrial	1,194	145	55	6	0	1,400
Religion	258	22	6	1	0	287
Other Residential	16,838	2,267	701	55	1	19,862
Single Family	44,936	2,260	57	0	0	47,253

Structural damage states vary by building type. See HAZUS Technical Manual Vol. I. "Complete damage" indicates structural collapse or is in imminent danger of collapse.

**Direct Economic Losses For Buildings**

Capital Stock Losses				Income Losses					Total Loss
Cost Structural Damage	Cost Non-structural Damage	Cost Contents Damage	Inventory Loss	Loss Ratio %	Relocation Loss	Capital Loss	Wages Losses	Rental Income Loss	
\$7,888,000	\$49,646,000	\$26,463,000	\$1,125,000	0.4	\$3,905,000	\$1,963,000	\$2,377,000	\$2,231,000	\$95,598,000

**Hospital Functionality**

	At Day 1			At day 3		At day 7		At day 30		At day 90	
	Total Number of Beds	Number of Beds	%								
Large	270	252	99	252	94	269	100	270	100	270	100
Medium											
Small	47	46	98	46	98	47	100	47	100	47	100
<b>Total</b>	<b>317</b>	<b>298</b>	<b>—</b>	<b>298</b>	<b>—</b>	<b>316</b>	<b>—</b>	<b>317</b>	<b>—</b>	<b>317</b>	<b>—</b>

Large Hospital: > 150 beds

Medium Hospital: 50-150 beds

Small Hospital: < 50 beds

**Highway Bridge Damage**

Total Number of Bridges	Average Number for Damage State				
	None	Slight	Moderate	Extensive	Complete
276 (279*)	251	8	6	8	3

\* values in parentheses include rounding error.

**Scenario: M 6.8 Boulder Creek Fault  
Whatcom County**

**Fire Following Analysis Summary Report**

Number of Ignitions	Population Exposed	Value Exposed
7	764	\$49,814,000

**Potable Water System Performance**

Total Households	Number of Households Without Water									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
71,691	0	0	0	0	0	0	0	0	0	0

**Electrical Power System Performance**

Total Households	Number of Households Without Power									
	At day 1		At day 3		At day 7		At day 30		At day 90	
	Count	%	Count	%	Count	%	Count	%	Count	%
71,691	0	0	0	0	0	0	0	0	0	0

**Debris Summary Report**

Brick, Wood & Others (tons)	Concrete & Steel (tons)	Total (tons)	Number of Truckloads
9,000	7,000	16,000	640

**Shelter Summary Report**

Number of Displaced Households	Number of People Needing Short Term Shelter
9	6

**Essential Facilities Functionality**

	Count	Functionality (%)
		At Day 1
Emergency Operation Center	2	94
Fire Station Facilities	51	91
Police Station Facilities	9	90
School	91	91

# HAZUS-MH: Earthquake Event Report

---

**Region Name:** BoulderCreekM68Oct09Redo

**Earthquake Scenario:** Boulder Creek M6.8 Redo Oct09

**Print Date:** March 09, 2010

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

**Disclaimer:**

*The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.*

## Table of Contents

<b>Section</b>	<b>Page #</b>
<b>General Description of the Region</b>	<b>3</b>
<b>Building and Lifeline Inventory</b>	<b>4</b>
Building Inventory	
Critical Facility Inventory	
Transportation and Utility Lifeline Inventory	
<b>Earthquake Scenario Parameters</b>	<b>6</b>
<b>Direct Earthquake Damage</b>	<b>7</b>
Buildings Damage	
Critical Facilities Damage	
Transportation and Utility Lifeline Damage	
<b>Induced Earthquake Damage</b>	<b>11</b>
Fire Following Earthquake	
Debris Generation	
<b>Social Impact</b>	<b>12</b>
Shelter Requirements	
Casualties	
<b>Economic Loss</b>	<b>13</b>
Building Losses	
Transportation and Utility Lifeline Losses	
Long-term Indirect Economic Impacts	
<b>Appendix A: County Listing for the Region</b>	
<b>Appendix B: Regional Population and Building Value Data</b>	

## General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 23 county(ies) from the following state(s):

Washington

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 36,495.82 square miles and contains 1,084 census tracts. There are over 2,043 thousand households in the region and has a total population of 5,283,432 people (2005 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 1,877 thousand buildings in the region with a total building replacement value (excluding contents) of 402,081 (millions of dollars). Approximately 92.00 % of the buildings (and 0.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 151,145 and 21,726 (millions of dollars) , respectively.

## Building and Lifeline Inventory

### **Building Inventory**

HAZUS estimates that there are 1,877 thousand buildings in the region which have an aggregate total replacement value of 402,081 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 81% of the building inventory. The remaining percentage is distributed between the other general building types.

### **Critical Facility Inventory**

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 75 hospitals in the region with a total bed capacity of 14,258 beds. There are 2,254 schools, 938 fire stations, 226 police stations and 55 emergency operation facilities. With respect to HPL facilities, there are 450 dams identified within the region. Of these, 146 of the dams are classified as 'high hazard'. The inventory also includes 839 hazardous material sites, 0 military installations and 0 nuclear power plants.

### **Transportation and Utility Lifeline Inventory**

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 172,871.00 (millions of dollars). This inventory includes over 9,562 kilometers of highways, 4,996 bridges, 286,170 kilometers of pipes.

**Table 1: Transportation System Lifeline Inventory**

<b>System</b>	<b>Component</b>	<b># locations/ # Segments</b>	<b>Replacement value (millions of dollars)</b>
<b>Highway</b>	Bridges	4,996	90,051.60
	Segments	3,454	53,323.90
	Tunnels	29	67.00
		<b>Subtotal</b>	<b>143,442.50</b>
<b>Railways</b>	Bridges	77	20.00
	Facilities	68	181.10
	Segments	1,407	2,642.40
	Tunnels	0	0.00
		<b>Subtotal</b>	<b>2,843.50</b>
<b>Light Rail</b>	Bridges	0	0.00
	Facilities	38	101.20
	Segments	48	203.90
	Tunnels	0	0.00
		<b>Subtotal</b>	<b>305.00</b>
<b>Bus</b>	Facilities	45	54.00
		<b>Subtotal</b>	<b>54.00</b>
<b>Ferry</b>	Facilities	45	59.90
		<b>Subtotal</b>	<b>59.90</b>
<b>Port</b>	Facilities	486	970.50
		<b>Subtotal</b>	<b>970.50</b>
<b>Airport</b>	Facilities	62	660.40
	Runways	74	2,809.30
		<b>Subtotal</b>	<b>3,469.70</b>
		<b>Total</b>	<b>151,145.10</b>

**Table 2: Utility System Lifeline Inventory**

<b>System</b>	<b>Component</b>	<b># Locations / Segments</b>	<b>Replacement value (millions of dollars)</b>
<b>Potable Water</b>	Distribution Lines	NA	2,861.70
	Facilities	41	1,501.80
	Pipelines	0	0.00
		<b>Subtotal</b>	<b>4,363.50</b>
<b>Waste Water</b>	Distribution Lines	NA	1,717.00
	Facilities	146	10,696.00
	Pipelines	0	0.00
		<b>Subtotal</b>	<b>12,413.00</b>
<b>Natural Gas</b>	Distribution Lines	NA	1,144.70
	Facilities	56	67.10
	Pipelines	0	0.00
		<b>Subtotal</b>	<b>1,211.80</b>
<b>Oil Systems</b>	Facilities	15	1.70
	Pipelines	0	0.00
		<b>Subtotal</b>	<b>1.70</b>
<b>Electrical Power</b>	Facilities	78	9,438.00
		<b>Subtotal</b>	<b>9,438.00</b>
<b>Communication</b>	Facilities	196	21.60
		<b>Subtotal</b>	<b>21.60</b>
		<b>Total</b>	<b>27,449.60</b>

## Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

<b>Scenario Name</b>	Boulder Creek M6.8 Redo Oct09
<b>Type of Earthquake</b>	User-defined
<b>Fault Name</b>	NA
<b>Historical Epicenter ID #</b>	NA
<b>Probabilistic Return Period</b>	NA
<b>Longitude of Epicenter</b>	NA
<b>Latitude of Epicenter</b>	NA
<b>Earthquake Magnitude</b>	6.80
<b>Depth (Km)</b>	NA
<b>Rupture Length (Km)</b>	NA
<b>Rupture Orientation (degrees)</b>	NA
<b>Attenuation Function</b>	NA

## Building Damage

### Building Damage

HAZUS estimates that about 1,235 buildings will be at least moderately damaged. This is over 0.00 % of the total number of buildings in the region. There are an estimated 1 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 3 below summaries the expected damage by general occupancy for the buildings in the region. Table 4 summaries the expected damage by general building type.

**Table 3: Expected Building Damage by Occupancy**

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Agriculture</b>	8,260	0.44	69	1.03	23	2.01	3	3.50	0	4.98
<b>Commercial</b>	98,166	5.25	521	7.78	137	11.80	10	13.10	0	15.09
<b>Education</b>	3,538	0.19	15	0.23	4	0.38	0	0.52	0	0.59
<b>Government</b>	2,356	0.13	10	0.15	3	0.23	0	0.23	0	0.25
<b>Industrial</b>	30,361	1.62	196	2.93	65	5.64	6	7.60	0	8.38
<b>Other Residential</b>	379,360	20.29	3,199	47.74	858	74.15	57	73.95	1	69.89
<b>Religion</b>	6,827	0.37	29	0.43	7	0.60	1	0.69	0	0.82
<b>Single Family</b>	1,340,993	71.72	2,661	39.72	60	5.19	0	0.41	0	0.00
<b>Total</b>	<b>1,869,861</b>		<b>6,701</b>		<b>1,157</b>		<b>77</b>		<b>1</b>	

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
<b>Wood</b>	1,513,244	80.93	3327	49.66	79	6.83	0	0.46	0	0.10
<b>Steel</b>	40,262	2.15	223	3.32	77	6.70	5	7.03	0	7.93
<b>Concrete</b>	39,301	2.10	212	3.16	53	4.54	4	4.99	0	2.96
<b>Precast</b>	28,829	1.54	188	2.80	71	6.11	7	9.13	0	8.46
<b>RM</b>	69,599	3.72	161	2.40	51	4.42	4	5.75	0	2.20
<b>URM</b>	15,031	0.80	263	3.93	76	6.55	7	8.61	0	21.74
<b>MH</b>	163,595	8.75	2327	34.73	750	64.86	49	64.03	1	56.61
<b>Total</b>	<b>1,869,861</b>		<b>6,701</b>		<b>1,157</b>		<b>77</b>		<b>1</b>	

\*Note:

RM Reinforced Masonry  
URM Unreinforced Masonry  
MH Manufactured Housing

## **Essential Facility Damage**

Before the earthquake, the region had 14,258 hospital beds available for use. On the day of the earthquake, the model estimates that only 14,239 hospital beds (100.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 100.00% of the beds will be back in service. By 30 days, 100.00% will be operational.

**Table 5: Expected Damage to Essential Facilities**

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	75	0	0	75
Schools	2,254	0	0	2,253
EOCs	55	0	0	55
PoliceStations	226	0	0	226
FireStations	938	0	0	936

## Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

**Table 6: Expected Damage to the Transportation Systems**

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	3,454	0	0	3,454	3,454
	Bridges	4,996	10	0	4,986	4,992
	Tunnels	29	0	0	29	29
Railways	Segments	1,407	0	0	1,407	1,407
	Bridges	77	0	0	77	77
	Tunnels	0	0	0	0	0
	Facilities	68	0	0	68	68
Light Rail	Segments	48	0	0	48	48
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	38	0	0	38	38
Bus	Facilities	45	0	0	45	45
Ferry	Facilities	45	0	0	45	45
Port	Facilities	486	0	0	486	486
Airport	Facilities	62	0	0	62	62
	Runways	74	0	0	74	74

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

**Table 7 : Expected Utility System Facility Damage**

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	41	0	0	41	41
Waste Water	146	0	0	144	146
Natural Gas	56	0	0	54	56
Oil Systems	15	0	0	15	15
Electrical Power	78	1	0	76	78
Communication	196	0	0	196	196

**Table 8 : Expected Utility System Pipeline Damage (Site Specific)**

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	143,085	93	28
Waste Water	85,851	73	22
Natural Gas	57,234	79	24
Oil	0	0	0

**Table 9: Expected Potable Water and Electric Power System Performance**

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	2,043,617	0	0	0	0	0
Electric Power		0	0	0	0	0

### **Fire Following Earthquake**

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 10 ignitions that will burn about 0.42 sq. mi (0.00 % of the region's total area.) The model also estimates that the fires will displace about 894 people and burn about 58 (millions of dollars) of building value.

### **Debris Generation**

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.020 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 57.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 800,000 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

## Social Impact

### **Shelter Requirement**

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 9 households to be displaced due to the earthquake. Of these, 6 people (out of a total population of 5,283,432) will seek temporary shelter in public shelters.

### **Casualties**

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
<b>2 AM</b>	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	9	1	0	0
	Single Family	4	0	0	0
	<b>Total</b>	<b>13</b>	<b>1</b>	<b>0</b>	<b>0</b>
<b>2 PM</b>	Commercial	8	1	0	0
	Commuting	0	0	0	0
	Educational	3	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	2	0	0	0
	Single Family	1	0	0	0
	<b>Total</b>	<b>14</b>	<b>1</b>	<b>0</b>	<b>0</b>
<b>5 PM</b>	Commercial	6	0	0	0
	Commuting	1	2	3	1
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	3	0	0	0
	Single Family	2	0	0	0
	<b>Total</b>	<b>13</b>	<b>2</b>	<b>3</b>	<b>1</b>

## Economic Loss

The total economic loss estimated for the earthquake is 292.08 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

### Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 118.14 (millions of dollars); 11 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 48 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

**Table 11: Building-Related Economic Loss Estimates**

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
<b>Income Losses</b>							
	Wage	0.00	0.08	2.34	0.18	0.24	2.84
	Capital-Related	0.00	0.04	2.14	0.11	0.07	2.36
	Rental	0.16	0.69	1.74	0.07	0.08	2.75
	Relocation	0.26	1.27	1.97	0.38	0.72	4.60
	<b>Subtotal</b>	<b>0.42</b>	<b>2.07</b>	<b>8.19</b>	<b>0.75</b>	<b>1.12</b>	<b>12.54</b>
<b>Capital Stock Losses</b>							
	Structural	2.45	1.99	2.75	1.02	1.35	9.55
	Non_Structural	23.41	12.24	14.97	6.16	4.99	61.78
	Content	10.81	3.59	9.93	4.29	4.20	32.82
	Inventory	0.00	0.00	0.32	0.95	0.17	1.44
	<b>Subtotal</b>	<b>36.67</b>	<b>17.82</b>	<b>27.97</b>	<b>12.43</b>	<b>10.71</b>	<b>105.59</b>
	<b>Total</b>	<b>37.09</b>	<b>19.89</b>	<b>36.15</b>	<b>13.17</b>	<b>11.82</b>	<b>118.14</b>

## Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

**Table 12: Transportation System Economic Losses**  
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	53,323.90	\$4.80	0.01
	Bridges	90,051.61	\$28.37	0.03
	Tunnels	66.98	\$0.00	0.00
	<b>Subtotal</b>	<b>143442.50</b>	<b>33.20</b>	
Railways	Segments	2,642.42	\$0.12	0.00
	Bridges	19.99	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	181.08	\$1.07	0.59
	<b>Subtotal</b>	<b>2843.50</b>	<b>1.20</b>	
Light Rail	Segments	203.85	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	101.19	\$0.05	0.05
	<b>Subtotal</b>	<b>305.00</b>	<b>0.10</b>	
Bus	Facilities	53.96	\$0.42	0.77
	<b>Subtotal</b>	<b>54.00</b>	<b>0.40</b>	
Ferry	Facilities	59.90	\$0.47	0.78
	<b>Subtotal</b>	<b>59.90</b>	<b>0.50</b>	
Port	Facilities	970.54	\$10.31	1.06
	<b>Subtotal</b>	<b>970.50</b>	<b>10.30</b>	
Airport	Facilities	660.36	\$5.03	0.76
	Runways	2,809.34	\$0.00	0.00
	<b>Subtotal</b>	<b>3469.70</b>	<b>5.00</b>	
	<b>Total</b>	<b>151145.10</b>	<b>50.70</b>	

**Table 13: Utility System Economic Losses**

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	1,501.80	\$1.85	0.12
	Distribution Lines	2,861.70	\$0.47	0.02
	<b>Subtotal</b>	<b>4,363.54</b>	<b>\$2.32</b>	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	10,696.00	\$31.80	0.30
	Distribution Lines	1,717.00	\$0.37	0.02
	<b>Subtotal</b>	<b>12,412.98</b>	<b>\$32.17</b>	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	67.10	\$0.57	0.86
	Distribution Lines	1,144.70	\$0.39	0.03
	<b>Subtotal</b>	<b>1,211.83</b>	<b>\$0.97</b>	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	1.70	\$0.02	1.43
	<b>Subtotal</b>	<b>1.65</b>	<b>\$0.02</b>	
Electrical Power	Facilities	9,438.00	\$87.77	0.93
	<b>Subtotal</b>	<b>9,438.00</b>	<b>\$87.77</b>	
Communication	Facilities	21.60	\$0.03	0.12
	<b>Subtotal</b>	<b>21.56</b>	<b>\$0.03</b>	
	<b>Total</b>	<b>27,449.55</b>	<b>\$123.29</b>	

**Table 14. Indirect Economic Impact with outside aid**  
 (Employment as # of people and Income in millions of \$)

	LOSS	Total	%
<b>First Year</b>			
	Employment Impact	53,751	2.99
	Income Impact	157	0.18
<b>Second Year</b>			
	Employment Impact	15,510	0.86
	Income Impact	67	0.07
<b>Third Year</b>			
	Employment Impact	329	0.02
	Income Impact	14	0.02
<b>Fourth Year</b>			
	Employment Impact	16	0.00
	Income Impact	(2)	0.00
<b>Fifth Year</b>			
	Employment Impact	0	0.00
	Income Impact	(3)	0.00
<b>Years 6 to 15</b>			
	Employment Impact	0	0.00
	Income Impact	(3)	0.00

## **Appendix A: County Listing for the Region**

Chelan,WA

Clallam,WA

Clark,WA

Cowlitz,WA

Grays Harbor,WA

Island,WA

Jefferson,WA

King,WA

Kitsap,WA

Kittitas,WA

Klickitat,WA

Lewis,WA

Mason,WA

Pacific,WA

Pierce,WA

San Juan,WA

Skagit,WA

Skamania,WA

Snohomish,WA

Thurston,WA

Wahkiakum,WA

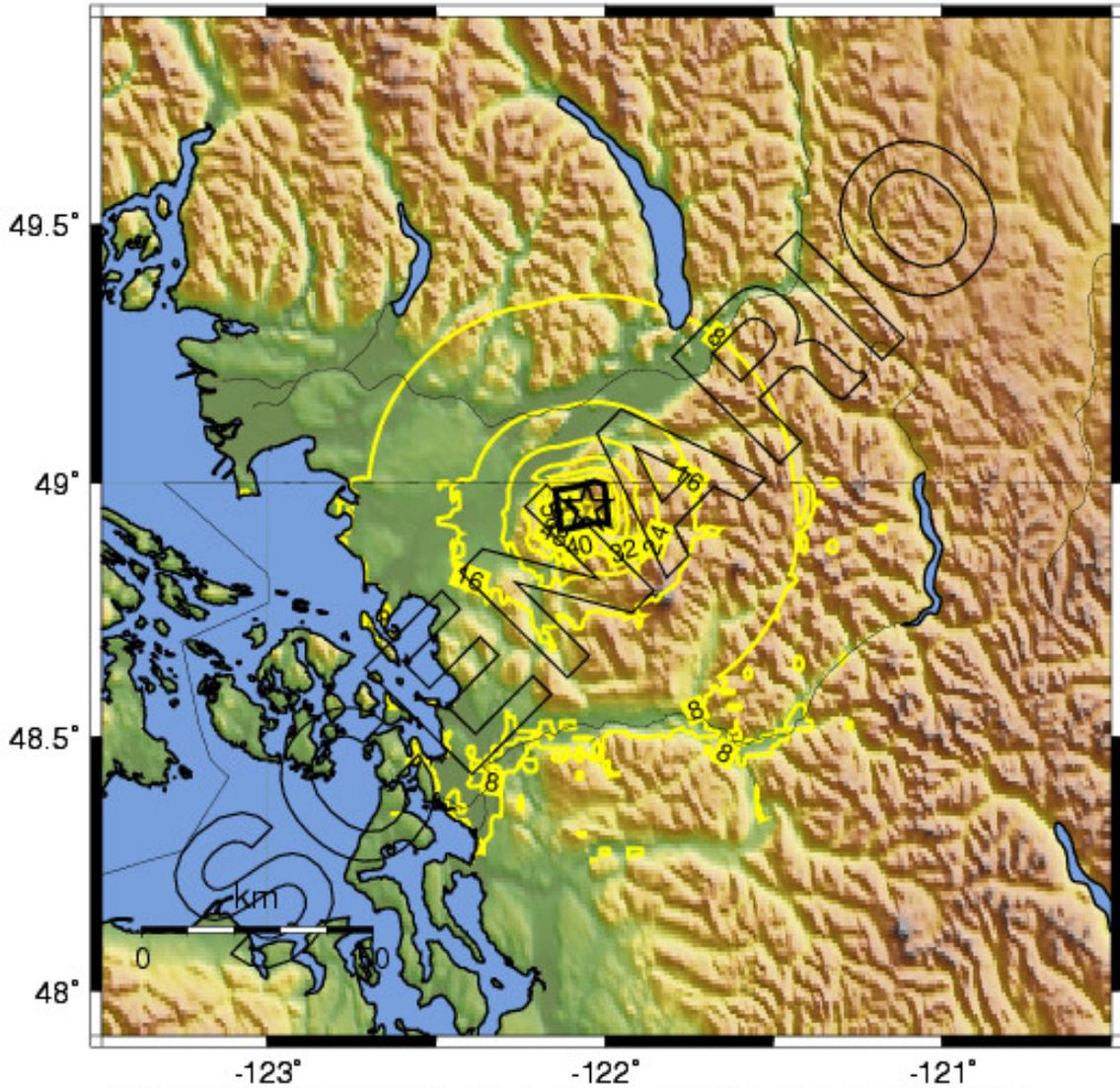
Whatcom,WA

Yakima,WA

**Appendix B: Regional Population and Building Value Data**

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Washington	Chelan	68,646	3,915	1,524	5,439
	Clallam	68,232	3,789	1,128	4,917
	Clark	395,707	21,358	5,081	26,439
	Cowlitz	96,113	5,167	1,575	6,742
	Grays Harbor	69,881	3,866	1,228	5,095
	Island	78,149	5,289	842	6,132
	Jefferson	28,169	1,741	517	2,258
	King	1,828,516	123,492	35,829	159,322
	Kitsap	245,278	14,460	2,974	17,435
	Kittitas	37,701	2,087	539	2,627
	Klickitat	20,162	908	287	1,195
	Lewis	70,750	3,424	1,286	4,711
	Mason	53,236	3,094	593	3,687
	Pacific	20,855	1,443	384	1,828
	Pierce	757,734	42,208	10,185	52,394
	San Juan	15,413	1,454	350	1,805
	Skagit	111,356	6,119	1,896	8,015
	Skamania	10,300	551	118	670
	Snohomish	661,444	38,562	8,570	47,132
	Thurston	226,721	12,793	3,286	16,080
Wahkiakum	3,900	204	62	267	
Whatcom	185,545	10,528	3,715	14,244	
Yakima	229,624	9,899	3,738	13,637	
<b>Total State</b>		<b>5,283,432</b>	<b>316,351</b>	<b>85,707</b>	<b>402,071</b>
<b>Total Region</b>		<b>5,283,432</b>	<b>316,351</b>	<b>85,707</b>	<b>402,071</b>

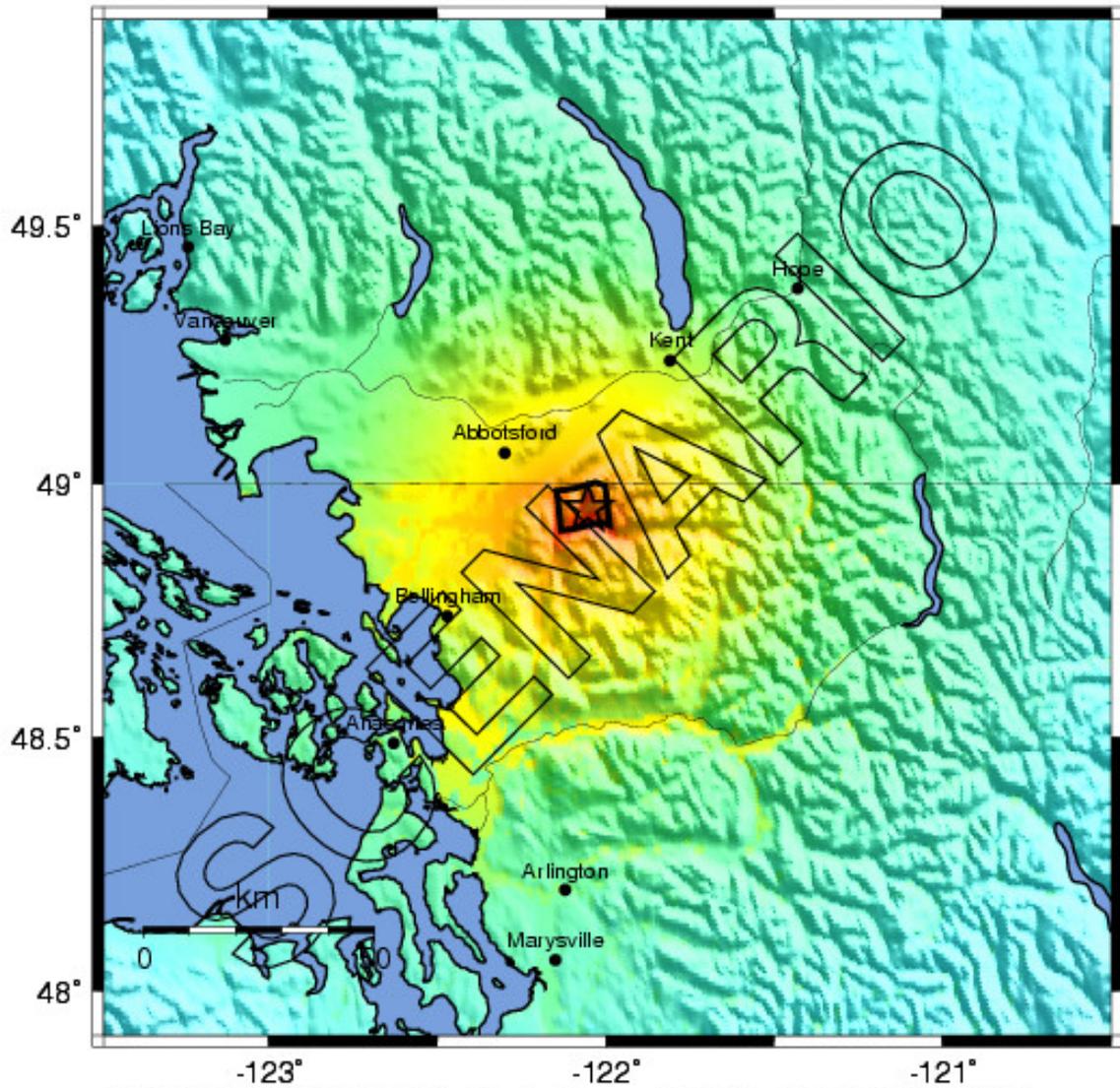
-- Earthquake Planning Scenario --  
Peak Accel. Map (in %g) for BoulderCreek6.8 Scenario  
Scenario Date: Tue May 5, 2009 12:00:00 GMT M 6.8 N48.95 W122.05 Depth: 0.0km



PLANNING SCENARIO ONLY -- Map Version 6 Processed Wed May 6, 2009 10:06:41 PM MDT

-- Earthquake Planning Scenario --  
 ShakeMap for BoulderCreek6.8 Scenario

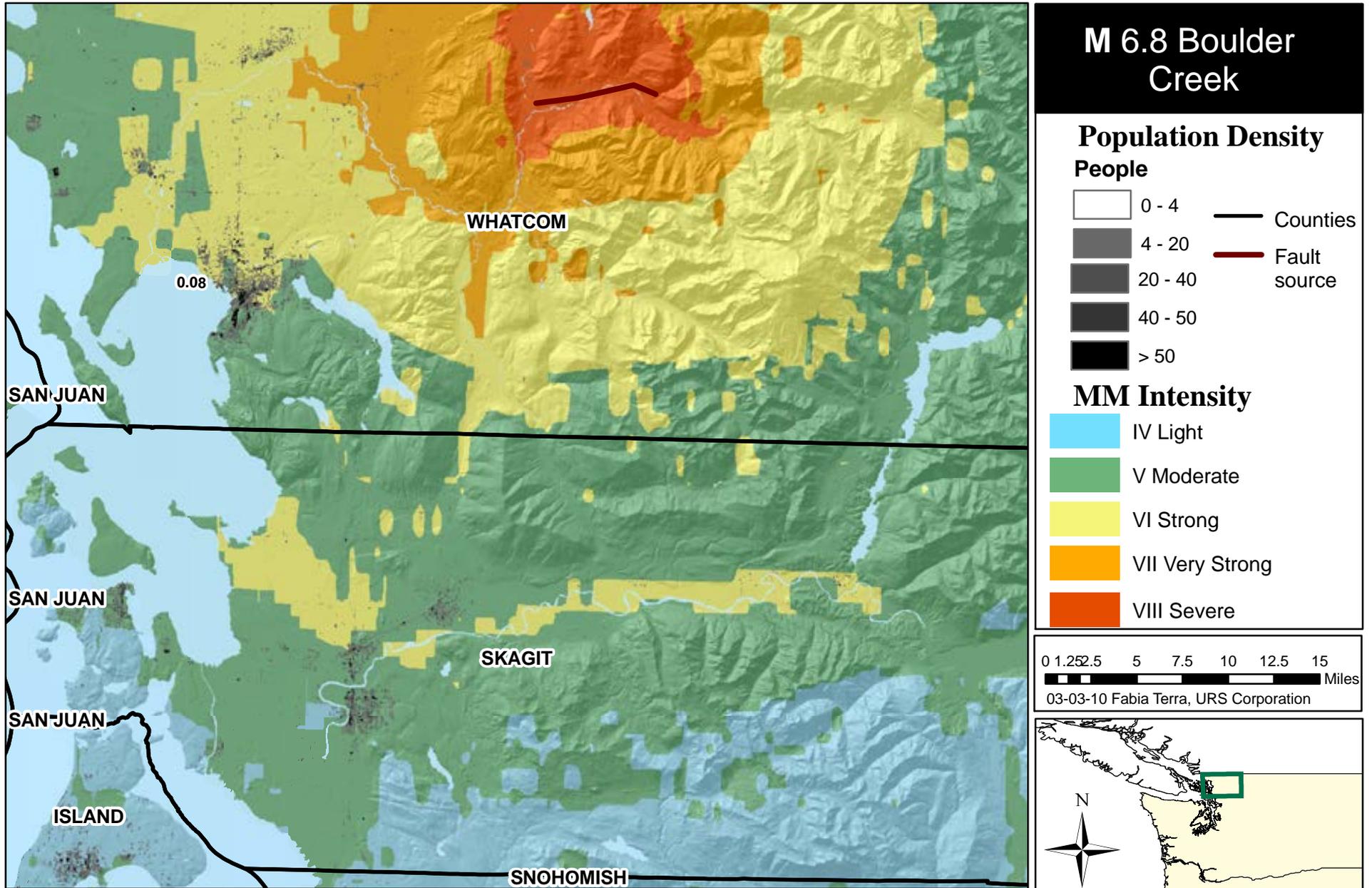
Scenario Date: Tue May 5, 2009 12:00:00 GMT M 6.8 N48.95 W122.05 Depth: 0.0km



PLANNING SCENARIO ONLY -- Map Version 6 Processed Wed May 6, 2009 10:06:41 PM MDT

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC. (%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

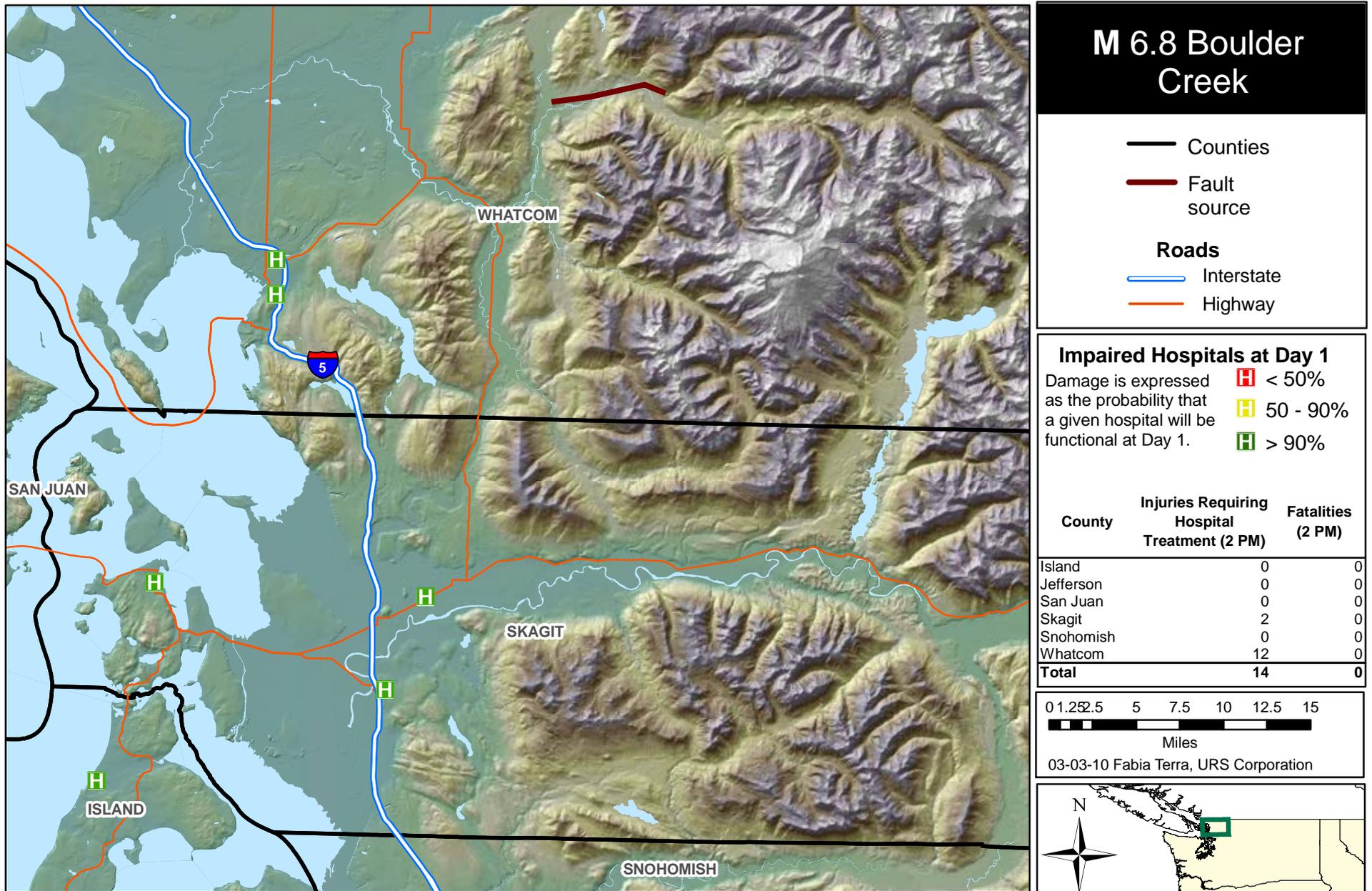
# Population Density and Ground Shaking Intensities - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, MMI Map USGS 2009  
Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 1

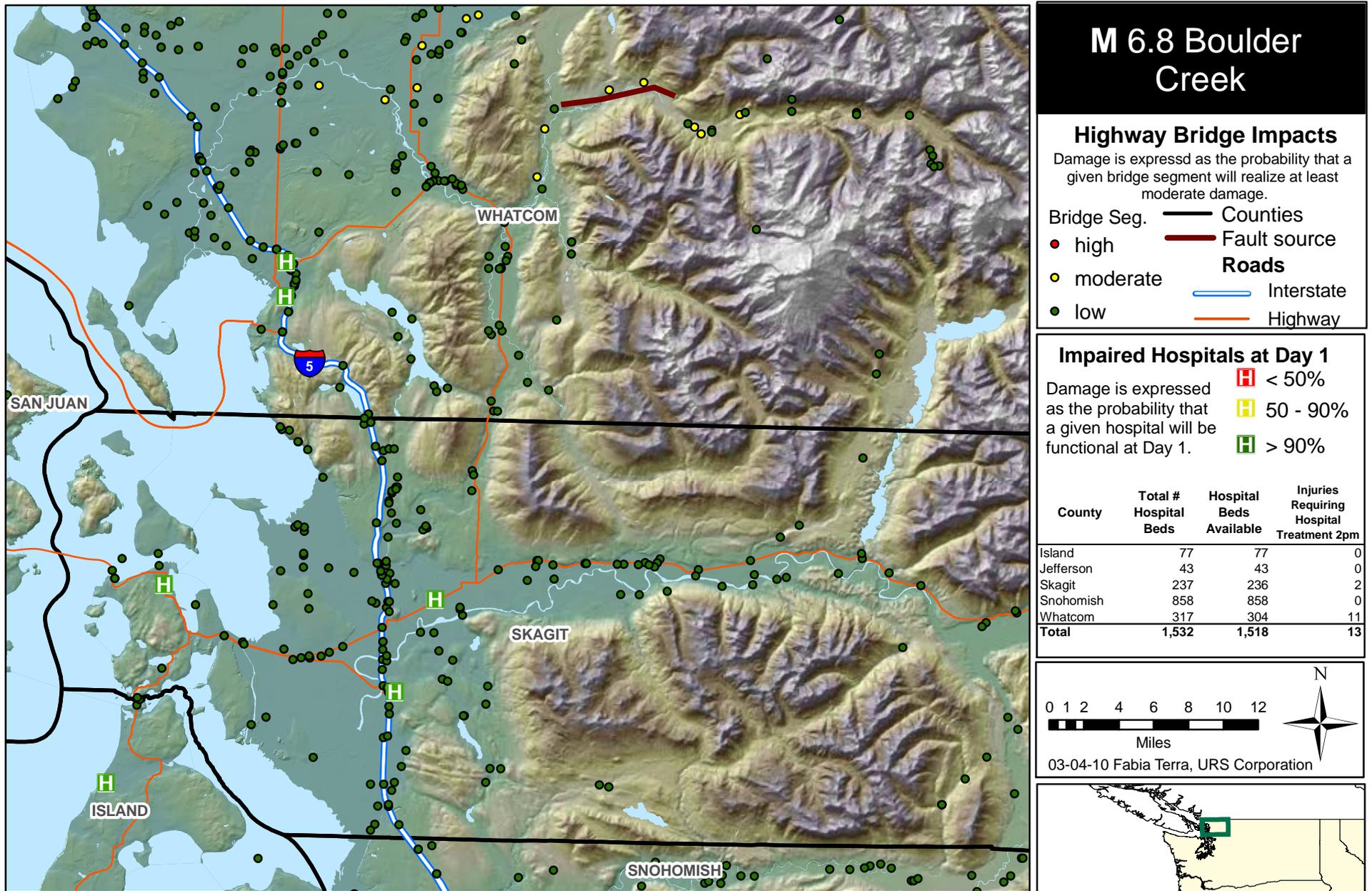
# Injuries (2 pm) and Impaired Hospitals (Day 1) - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 2

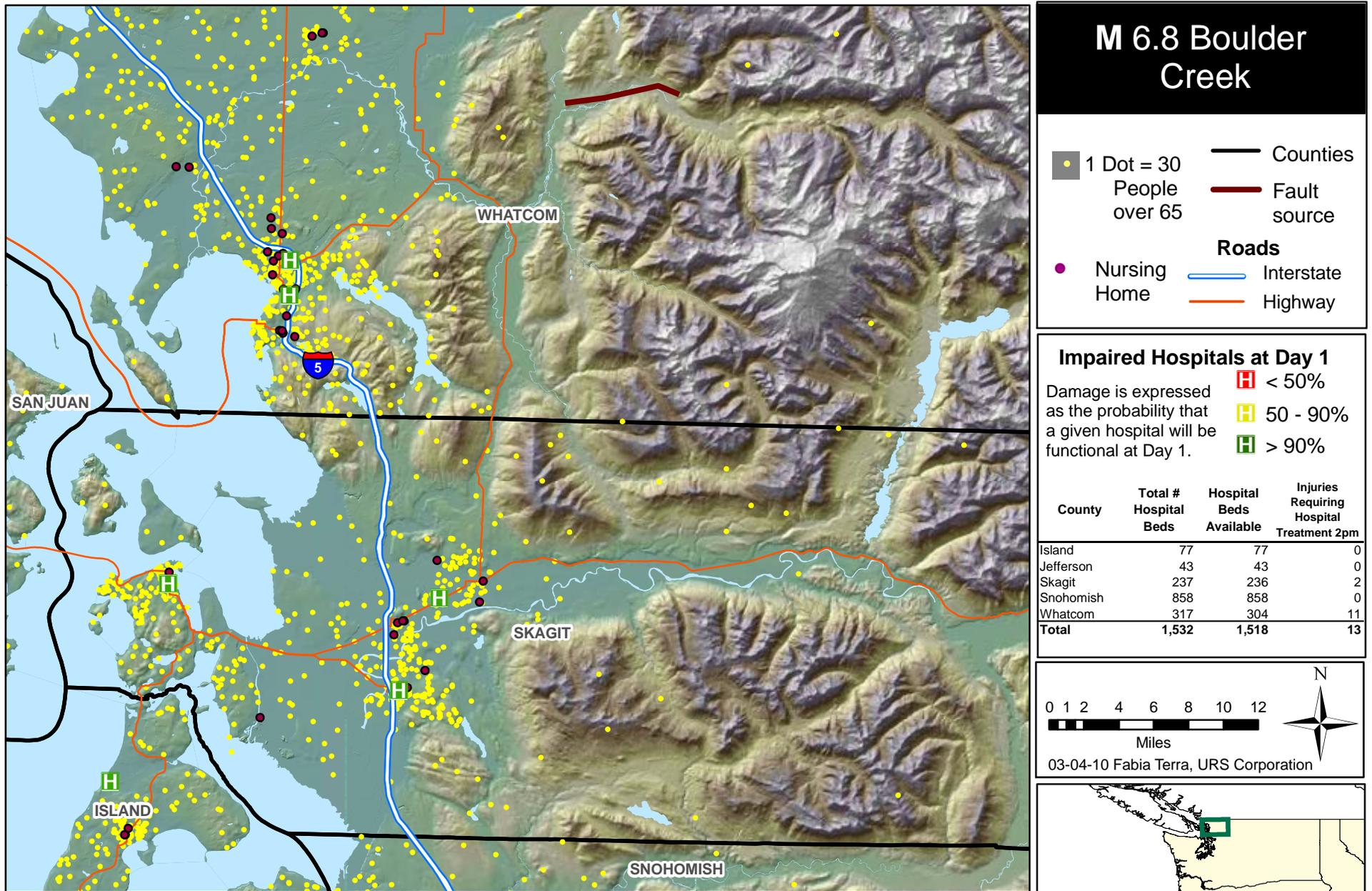
# Impaired Hospitals (Day 1), Hospital Bed Availability, & Bridge Functionality - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 3

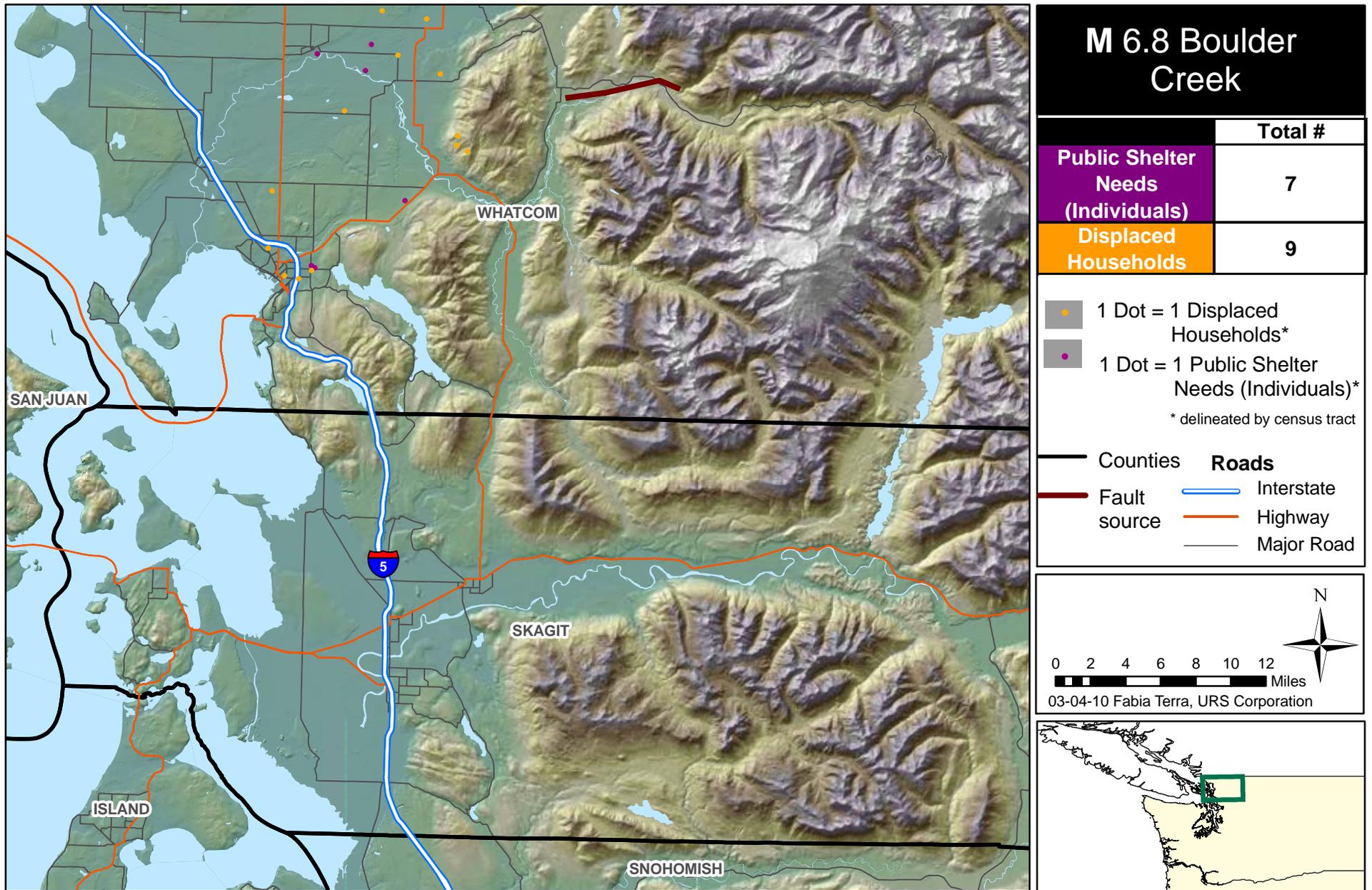
# Distribution of Elderly, Impaired Hospitals (Day 1), & Hospital Bed Availability - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways and Nursing homes HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 4

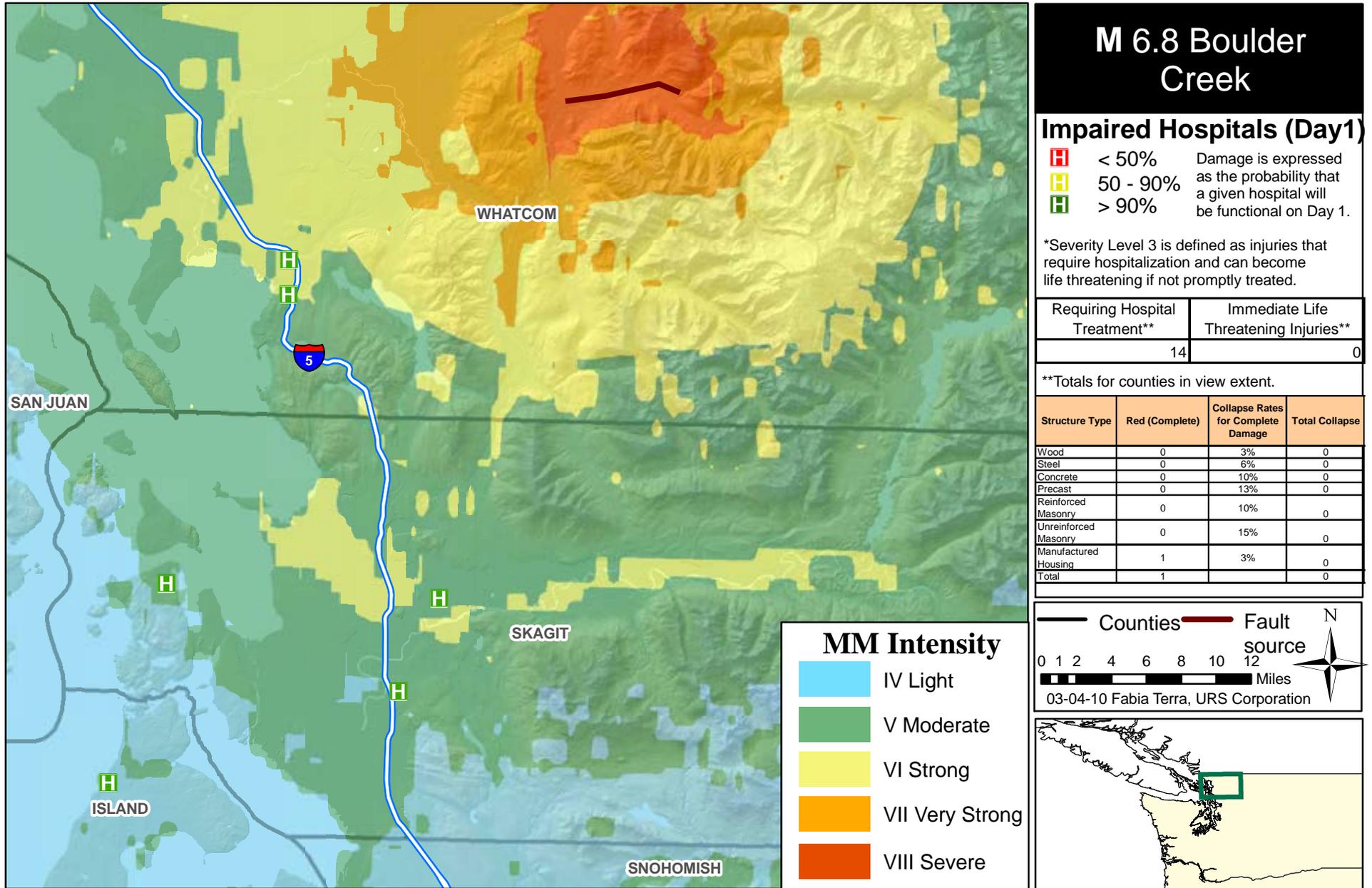
# Estimated Displaced Households & Short Term Public Shelter Needs - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 5

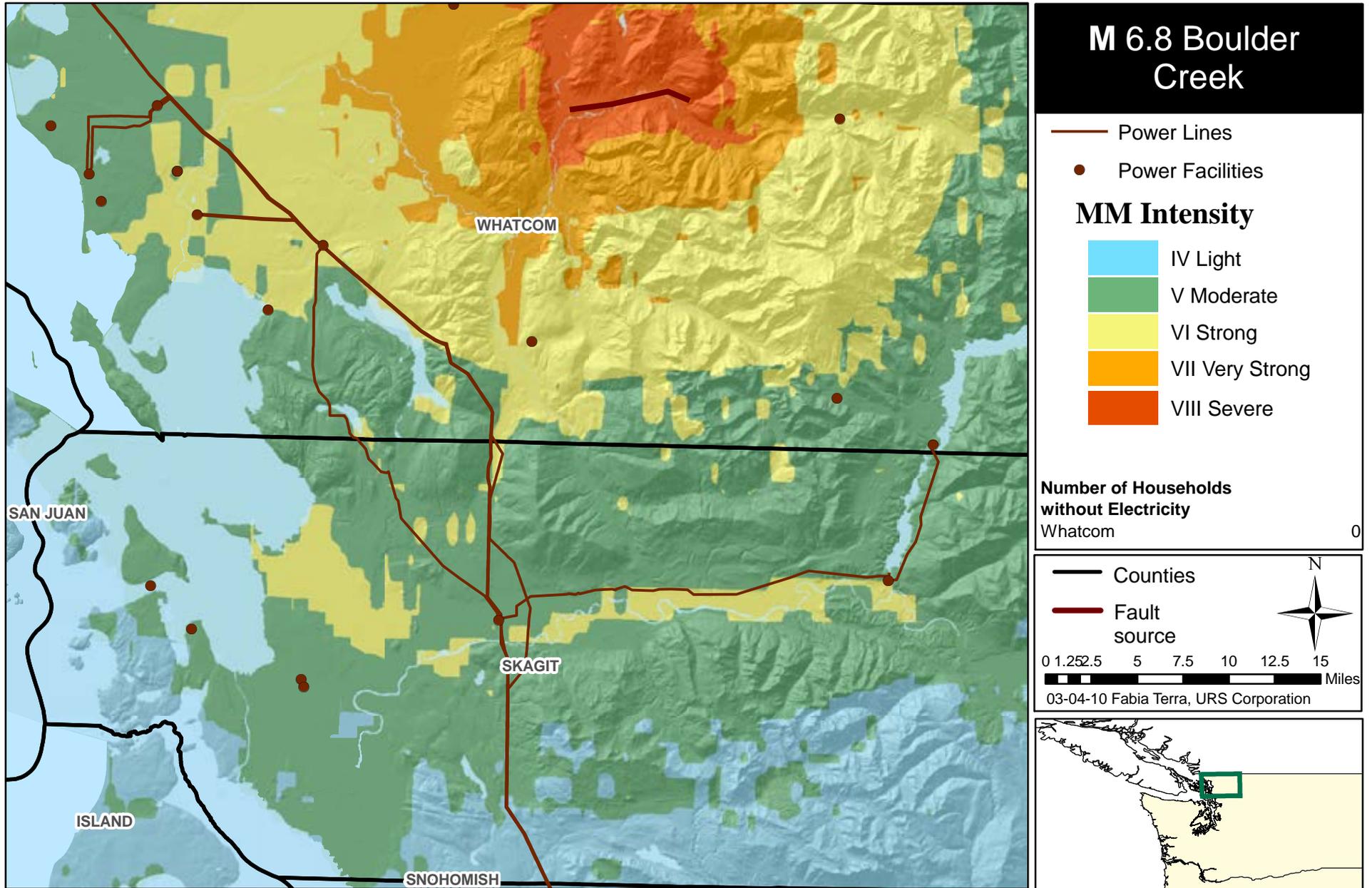
# Injuries at 2 pm, Collapsed Structures, and Impaired Hospitals - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 6

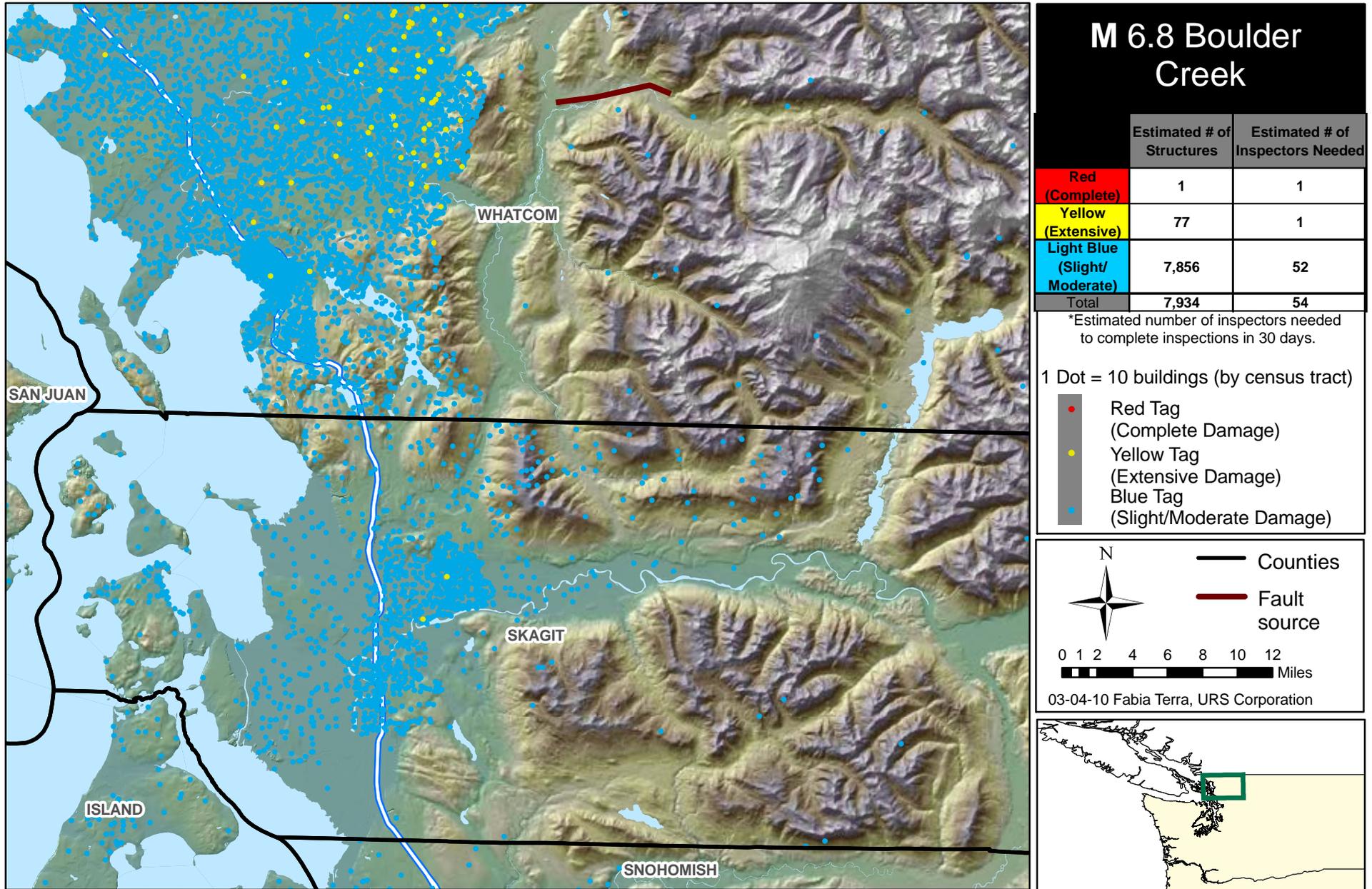
# Power Lines and Facilities, Households Without Electricity, and Ground Shaking Intensities - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Power lines and facilities HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 7

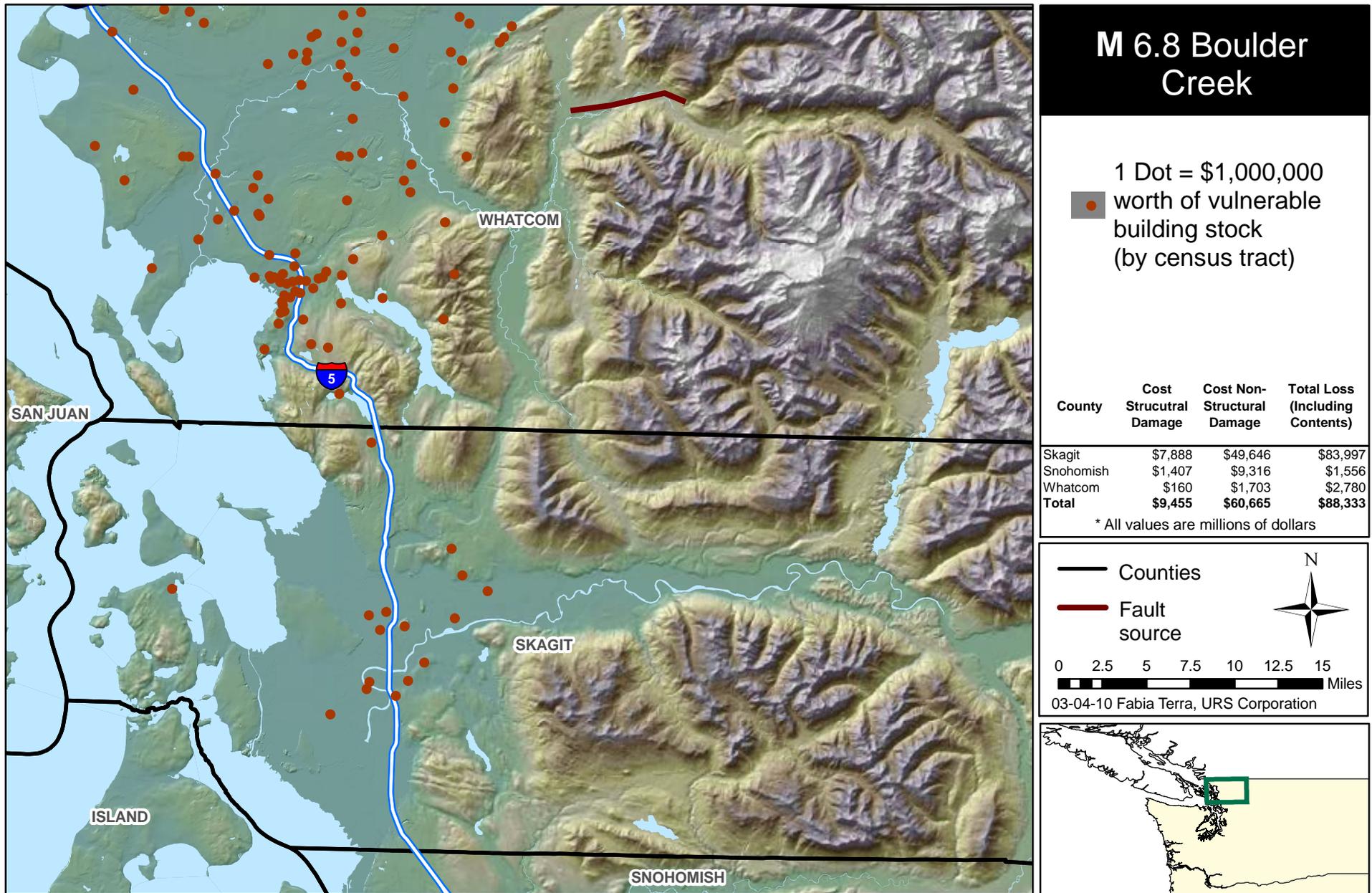
# Estimated Building Inspection Needs - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 8

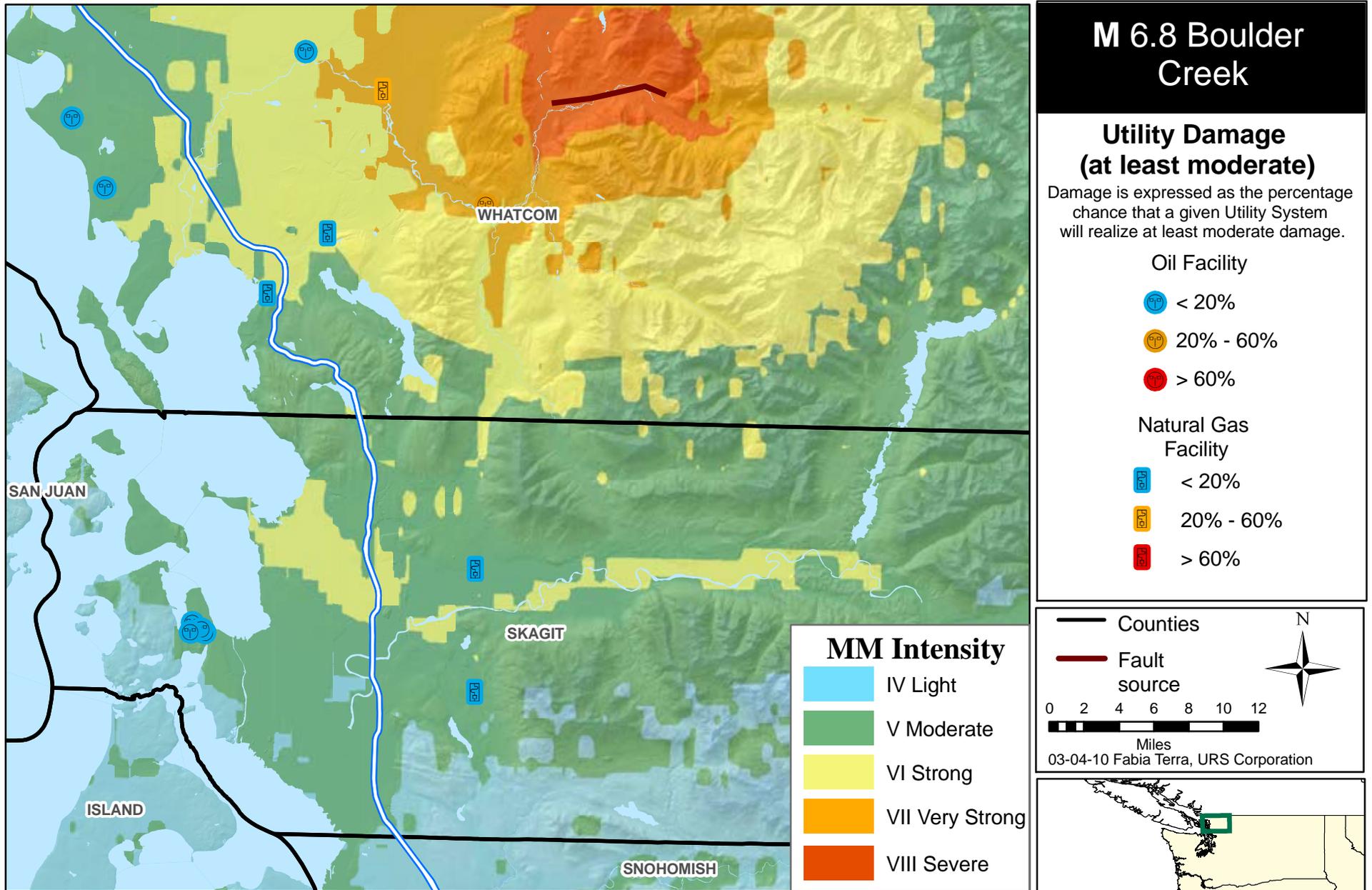
# Direct Building Economic Loss - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 9

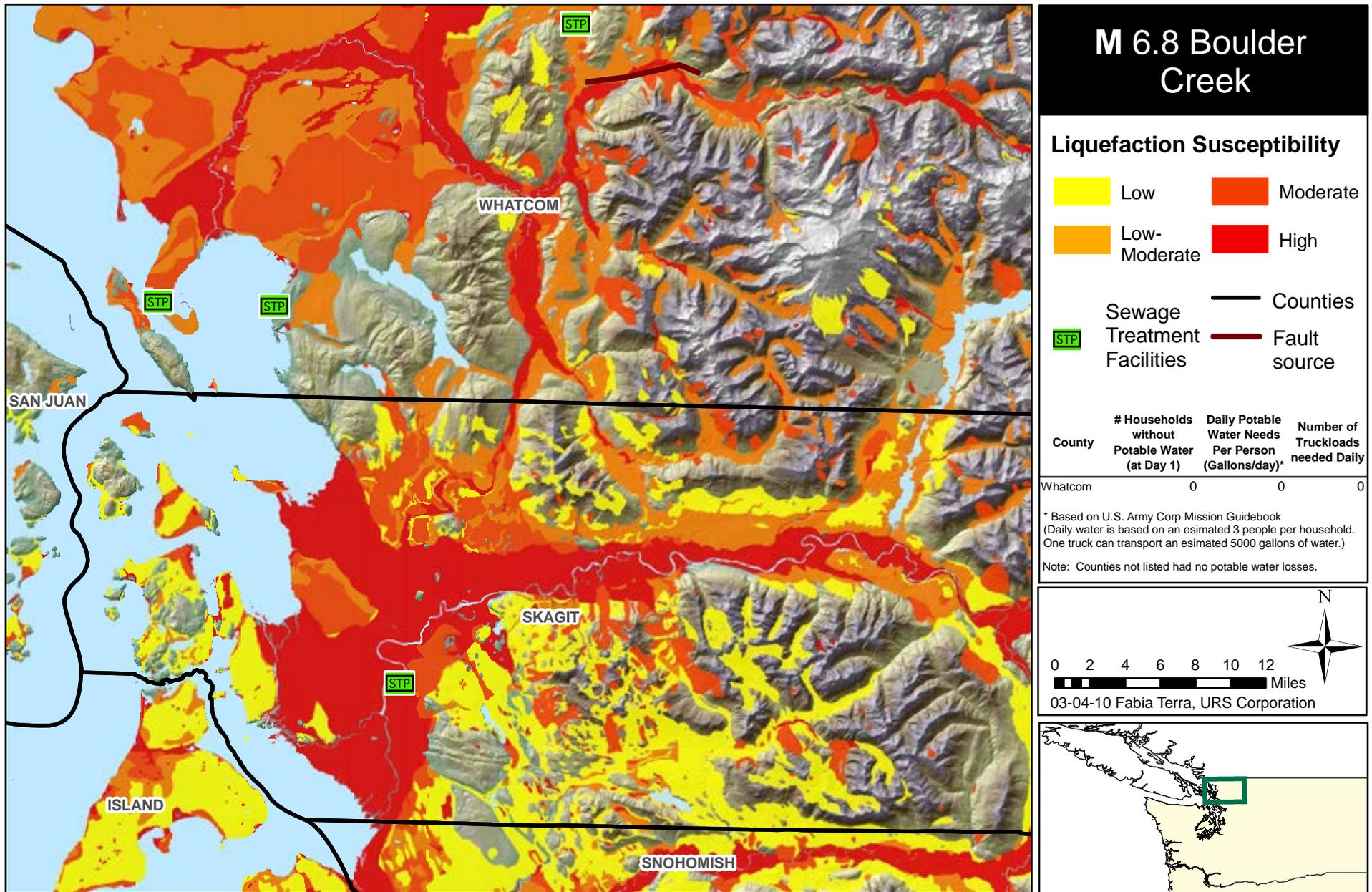
# Natural Gas, and Oil Facility Damage - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007, MMI Map USGS 2009  
Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 10

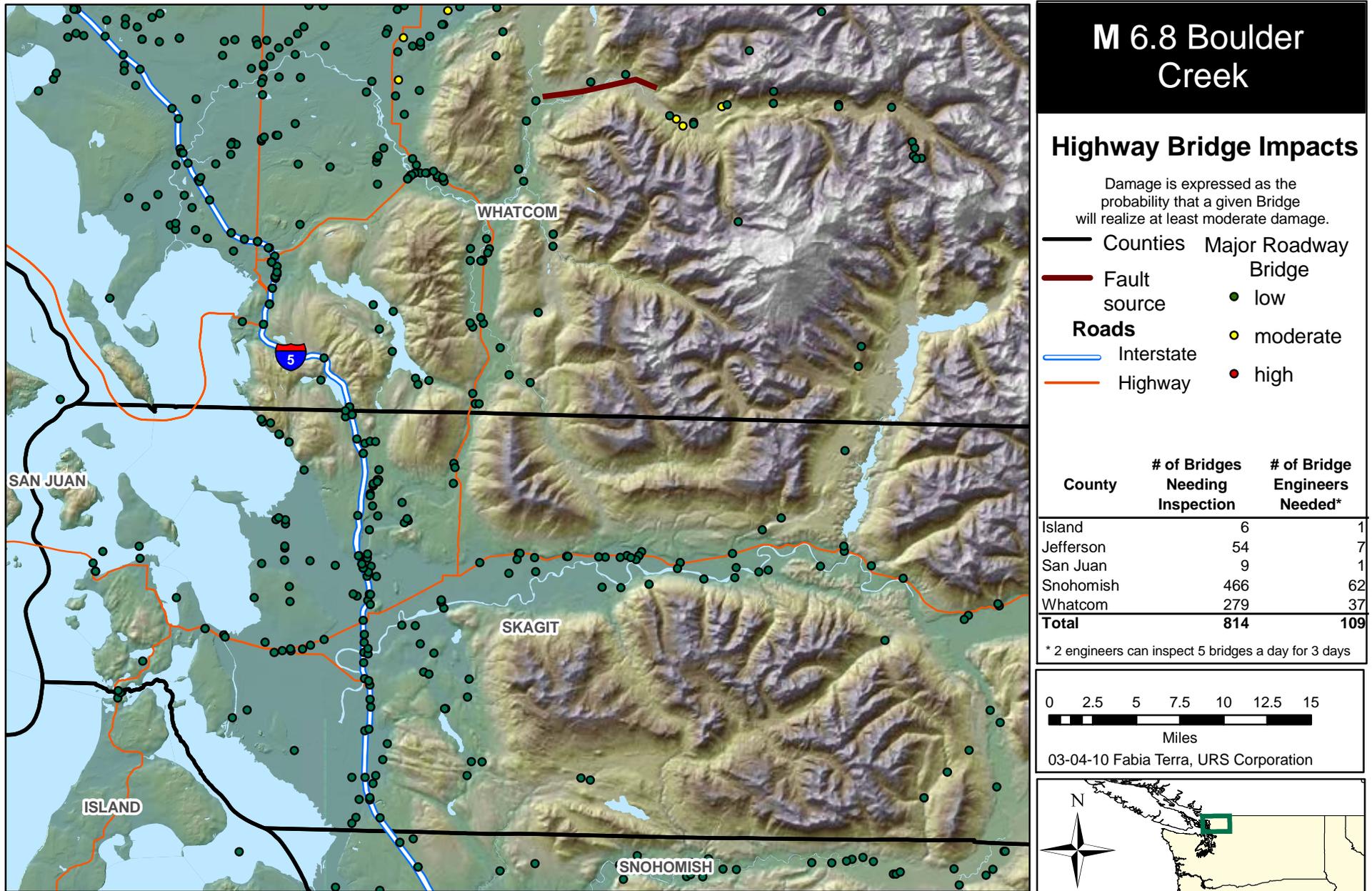
# Sewage Treatment Facility Distribution, Households Without Potable Water, and Liquefaction Susceptibility - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Sewage Treatment Facilities HSIP Gold 2007, Liquefaction The Wash State Geological Survey  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 11

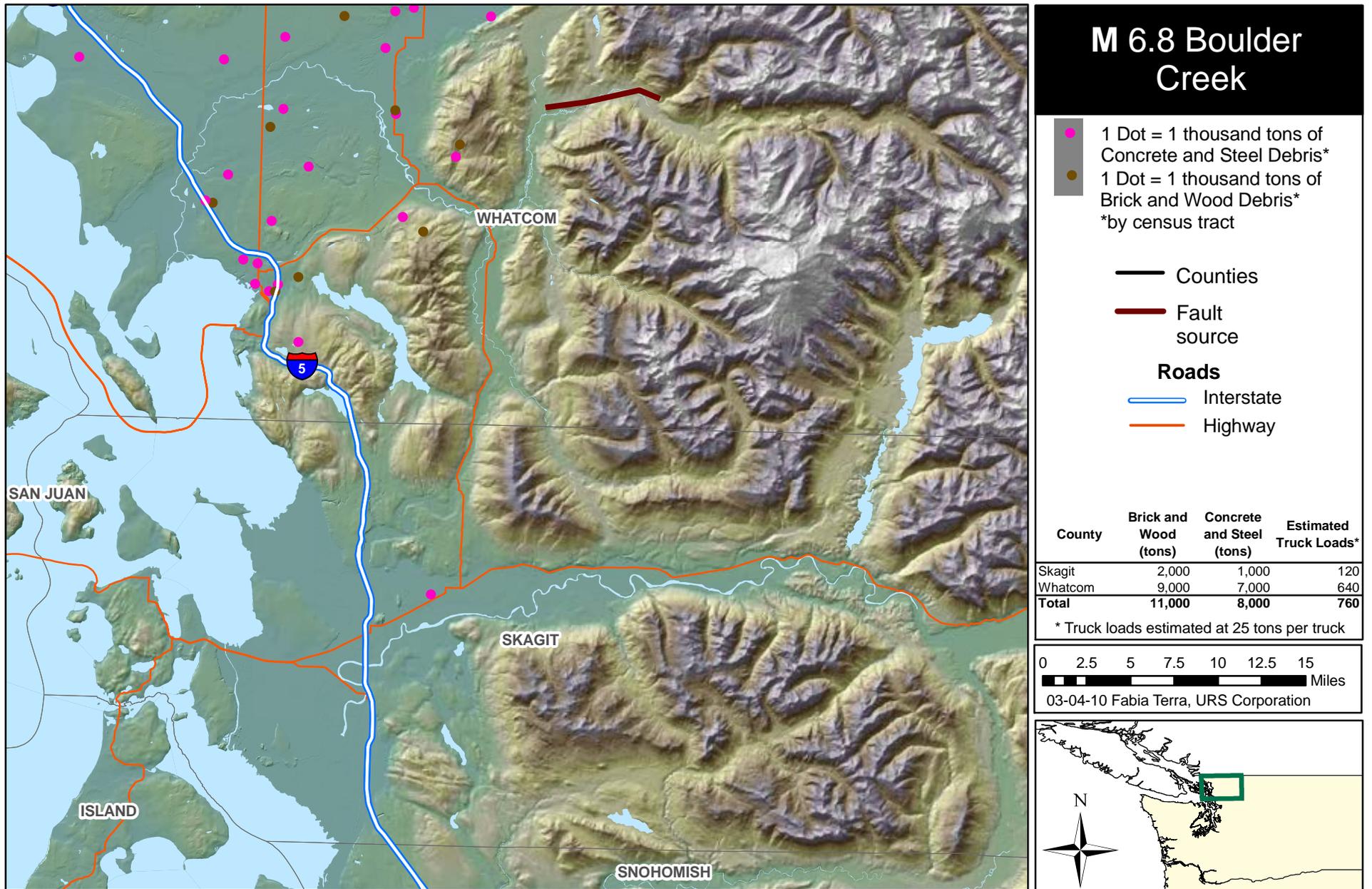
# Estimated Highway Bridge Damage - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
 Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 12

# Estimated Brick, Concrete, Steel, and Wood Debris - Earthquake Scenario: Washington



Sources: 2009 HAZUS runs by URS Corporation, Highways HSIP Gold 2007  
Projection: NAD83 Harn State Plane Washington 4602 (feet)

Figure 13