

HAZUS-MH: Earthquake Event Report

Region Name: Hansel Valley Fault Earthquake Mw 6.6 ShakeMap Scenario

Earthquake Scenario: Hansel Valley Fault Earthquake Mw 6.6 ShakeMap Scenario

Print Date: October 16, 2009

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.

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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 25 county(ies) from the following state(s):

Utah

Note:

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

The geographical size of the region is 69,762.11 square miles and contains 466 census tracts. There are over 719 thousand households in the region and has a total population of 2,311,929 people (2005 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 602 thousand buildings in the region with a total building replacement value (excluding contents) of 123,003 (millions of dollars). Approximately 95.00 % 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 47,017 and 8,410 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 602 thousand buildings in the region which have an aggregate total replacement value of 123,003 (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 44% 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 51 hospitals in the region with a total bed capacity of 6,443 beds. There are 996 schools, 299 fire stations, 122 police stations and 5 emergency operation facilities. With respect to HPL facilities, there are 510 dams identified within the region. Of these, 181 of the dams are classified as 'high hazard'. The inventory also includes 703 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 55,427.00 (millions of dollars). This inventory includes over 7,329 kilometers of highways, 2,732 bridges, 205,877 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	2,732	3,244.50
	Segments	1,163	39,190.80
	Tunnels	2	1.80
	Subtotal		42,437.00
Railways	Bridges	33	3.90
	Facilities	12	32.00
	Segments	1,408	2,646.30
	Tunnels	0	0.00
	Subtotal		2,682.20
Light Rail	Bridges	0	0.00
	Facilities	24	63.90
	Segments	24	37.20
	Tunnels	0	0.00
	Subtotal		101.10
Bus	Facilities	10	10.70
	Subtotal		10.70
Ferry	Facilities	1	1.30
	Subtotal		1.30
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	25	266.30
	Runways	40	1,518.60
	Subtotal		1,784.80
		Total	47,017.20

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	2,493.70
	Facilities	2	65.30
	Pipelines	0	0.00
	Subtotal		2,559.00
Waste Water	Distribution Lines	NA	1,496.20
	Facilities	52	3,393.90
	Pipelines	0	0.00
	Subtotal		4,890.20
Natural Gas	Distribution Lines	NA	997.50
	Facilities	8	8.50
	Pipelines	952	1,931.60
	Subtotal		2,937.60
Oil Systems	Facilities	29	2.80
	Pipelines	465	733.60
	Subtotal		736.40
Electrical Power	Facilities	21	2,263.80
	Subtotal		2,263.80
Communication	Facilities	113	11.10
	Subtotal		11.10
Total			13,398.00

Earthquake Scenario

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

Scenario Name	Hansel Valley Fault Earthquake Mw 6.6
Type of Earthquake	User-defined
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	6.60
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

HAZUS estimates that about 104 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 0 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 summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	522	0.09	0	0.03	0	0.03	0	0.00	0	0.00
Commercial	20,107	3.35	28	2.01	2	1.88	0	0.93	0	0.00
Education	815	0.14	1	0.07	0	0.09	0	0.09	0	0.00
Government	1,683	0.28	2	0.15	0	0.18	0	0.15	0	0.00
Industrial	7,195	1.20	13	0.91	1	0.97	0	0.60	0	0.00
Other Residential	67,980	11.31	247	17.83	16	15.64	0	2.73	0	0.00
Religion	2,547	0.42	2	0.17	0	0.16	0	0.09	0	0.00
Single Family	500,021	83.22	1,094	78.83	84	81.06	1	95.42	0	0.00
Total	600,869		1,387		103		1		0	

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

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	265,489	44.18	22	1.57	0	0.03	0	0.00	0	0.00
Steel	5,735	0.95	5	0.34	0	0.48	0	0.36	0	0.00
Concrete	4,759	0.79	3	0.22	0	0.09	0	0.03	0	0.00
Precast	3,463	0.58	3	0.25	1	0.52	0	0.61	0	0.00
RM	112,976	18.80	13	0.97	1	0.53	0	0.03	0	0.00
URM	186,053	30.96	1246	89.79	95	91.81	1	98.96	0	0.00
MH	22,393	3.73	95	6.86	7	6.54	0	0.00	0	0.00
Total	600,869		1,387		103		1		0	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 6,443 hospital beds available for use. On the day of the earthquake, the model estimates that only 6,440 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	51	0	0	51
Schools	996	0	0	996
EOCs	5	0	0	5
PoliceStations	122	0	0	122
FireStations	299	0	0	299

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	1,163	0	0	1,163	1,163
	Bridges	2,732	0	0	2,732	2,732
	Tunnels	2	0	0	2	2
Railways	Segments	1,408	0	0	1,408	1,408
	Bridges	33	0	0	33	33
	Tunnels	0	0	0	0	0
	Facilities	12	0	0	12	12
Light Rail	Segments	24	0	0	24	24
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	24	0	0	24	24
Bus	Facilities	10	0	0	10	10
Ferry	Facilities	1	0	0	1	1
Port	Facilities	0	0	0	0	0
Airport	Facilities	25	0	0	25	25
	Runways	40	0	0	40	40

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	2	0	0	2	2
Waste Water	52	0	0	52	52
Natural Gas	8	0	0	8	8
Oil Systems	29	0	0	29	29
Electrical Power	21	0	0	21	21
Communication	113	0	0	113	113

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

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	124,687	216	54
Waste Water	74,812	171	43
Natural Gas	4,009	1	0
Oil	2,370	1	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	719,968	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

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 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (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 0.010 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 94.00% 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 280 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 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 2,311,929) 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
2 AM	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	1	0	0	0
	Single Family	3	0	0	0
	Total	4	0	0	0
2 PM	Commercial	1	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	0	0	0	0
	Single Family	0	0	0	0
	Total	2	0	0	0
5 PM	Commercial	1	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	0	0	0	0
	Single Family	1	0	0	0
	Total	2	0	0	0

Economic Loss

The total economic loss estimated for the earthquake is 18.99 (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 12.02 (millions of dollars); 12 % 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 47 % 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
Income Losses							
	Wage	0.00	0.01	0.12	0.01	0.05	0.19
	Capital-Related	0.00	0.00	0.12	0.01	0.01	0.14
	Rental	0.13	0.14	0.22	0.01	0.01	0.50
	Relocation	0.36	0.05	0.12	0.03	0.03	0.59
	Subtotal	0.48	0.20	0.57	0.06	0.10	1.42
Capital Stock Losses							
	Structural	0.92	0.16	0.27	0.10	0.06	1.50
	Non_Structural	1.81	0.91	1.14	0.90	0.79	5.55
	Content	0.85	0.32	0.85	0.66	0.69	3.37
	Inventory	0.00	0.00	0.04	0.14	0.00	0.18
	Subtotal	3.58	1.39	2.30	1.81	1.54	10.61
	Total	4.07	1.59	2.86	1.87	1.63	12.02

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	39,190.79	\$0.00	0.00
	Bridges	3,244.49	\$0.37	0.01
	Tunnels	1.76	\$0.00	0.00
	Subtotal	42437.00	0.40	
Railways	Segments	2,646.33	\$0.00	0.00
	Bridges	3.92	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	31.96	\$0.24	0.76
	Subtotal	2682.20	0.20	
Light Rail	Segments	37.15	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	63.91	\$0.60	0.94
	Subtotal	101.10	0.60	
Bus	Facilities	10.68	\$0.07	0.63
	Subtotal	10.70	0.10	
Ferry	Facilities	1.33	\$0.00	0.11
	Subtotal	1.30	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	266.28	\$1.11	0.42
	Runways	1,518.56	\$0.00	0.00
	Subtotal	1784.80	1.10	
	Total	47017.20	2.40	

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	65.30	\$0.02	0.04
	Distribution Lines	2,493.70	\$0.97	0.04
	Subtotal	2,559.00	\$1.00	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	3,393.90	\$1.32	0.04
	Distribution Lines	1,496.20	\$0.77	0.05
	Subtotal	4,890.18	\$2.09	
Natural Gas	Pipelines	1,931.60	\$0.00	0.00
	Facilities	8.50	\$0.00	0.01
	Distribution Lines	997.50	\$0.82	0.08
	Subtotal	2,937.60	\$0.82	
Oil Systems	Pipelines	733.60	\$0.00	0.00
	Facilities	2.80	\$0.00	0.04
	Subtotal	736.40	\$0.00	
Electrical Power	Facilities	2,263.80	\$0.66	0.03
	Subtotal	2,263.80	\$0.66	
Communication	Facilities	11.10	\$0.00	0.03
	Subtotal	11.07	\$0.00	
	Total	13,398.05	\$4.57	

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

	LOSS	Total	%
First Year			
	Employment Impact	277	0.04
	Income Impact	1	0.00
Second Year			
	Employment Impact	89	0.01
	Income Impact	0	0.00
Third Year			
	Employment Impact	0	0.00
	Income Impact	0	0.00
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	0	0.00
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	0	0.00
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	0	0.00

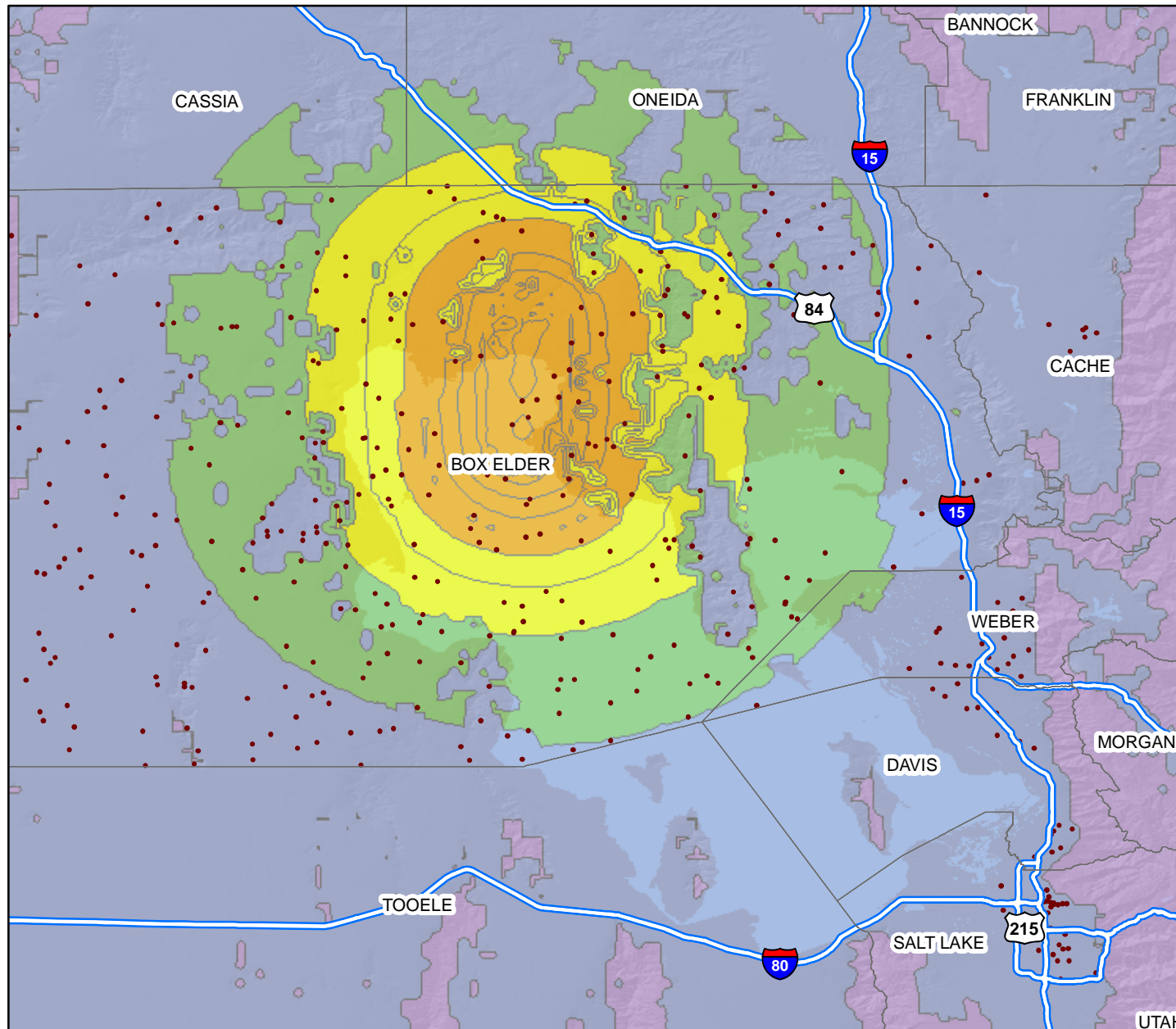
Appendix A: County Listing for the Region

Beaver,UT
Box Elder,UT
Cache,UT
Carbon,UT
Daggett,UT
Davis,UT
Duchesne,UT
Emery,UT
Grand,UT
Juab,UT
Millard,UT
Morgan,UT
Piute,UT
Rich,UT
Salt Lake,UT
San Juan,UT
Sanpete,UT
Sevier,UT
Summit,UT
Tooele,UT
Uintah,UT
Utah,UT
Wasatch,UT
Wayne,UT
Weber,UT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Utah	Beaver	6,295	252	89	341
	Box Elder	45,659	1,658	687	2,346
	Cache	100,585	3,382	1,703	5,085
	Carbon	19,947	825	395	1,220
	Daggett	884	74	18	92
	Davis	270,344	10,230	3,870	14,101
	Duchesne	15,233	496	248	744
	Emery	10,885	403	142	546
	Grand	8,891	350	195	546
	Juab	9,240	291	190	481
	Millard	12,713	447	233	681
	Morgan	7,910	305	139	444
	Piute	1,439	69	24	93
	Rich	2,327	249	38	288
	Salt Lake	962,837	39,526	18,636	58,162
	San Juan	14,341	443	164	608
	Sanpete	24,037	708	387	1,095
	Sevier	19,623	697	315	1,013
	Summit	35,804	2,598	708	3,307
	Tooele	50,184	1,782	564	2,347
	Uintah	26,973	851	460	1,312
	Utah	429,727	9,780	6,285	16,065
	Wasatch	18,879	0	89	89
	Wayne	2,590	115	38	154
	Weber	214,582	8,462	3,369	11,831
Total State		2,311,929	83,993	38,986	122,991
Total Region		2,311,929	83,993	38,986	122,991

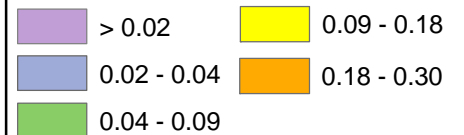
Direct Building Economic Loss - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

1 Dot = \$100,000

PGA (g's)

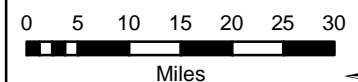


Counties

Potential Fault Source

County	Cost Structural Damage	Cost Non-Structural Damage	Total Loss (Including Contents)
Utah	\$0	\$17	\$31
Box Elder	\$7,270	\$18,164	\$33,692
Tooele	\$11	\$75	\$136
Salt Lake	\$443	\$1,819	\$3,433
Weber	\$432	\$1,378	\$2,587
Cache	\$107	\$459	\$855
Davis	\$197	\$920	\$1,692
Total	\$8,461	\$22,832	\$42,426

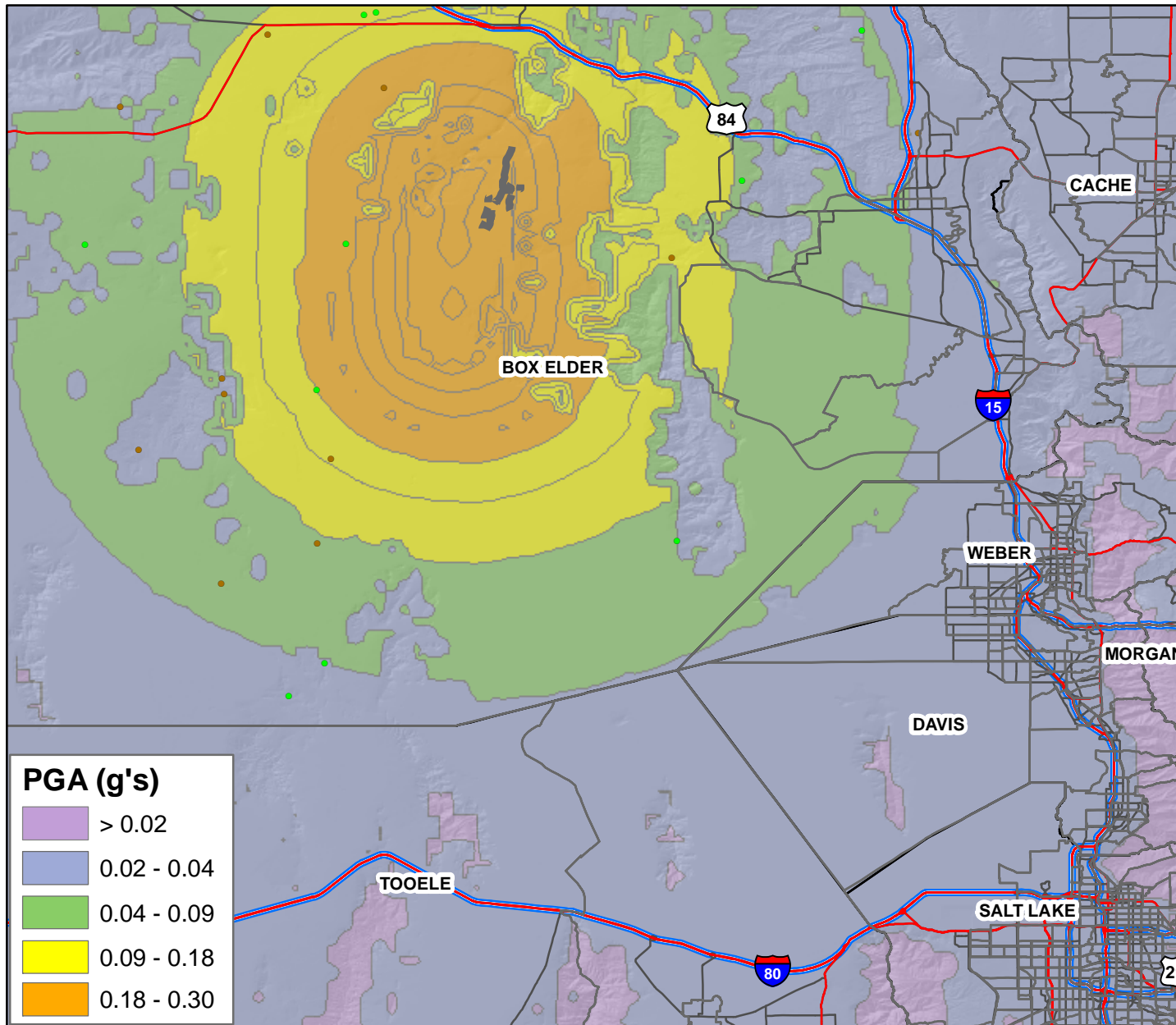
* All values are thousands of dollars



10-19-09 FEMA & URS Corporation

OR	ID	WY
NV	UT	CO
CA	AZ	NM

Estimated Displaced Households & Short Term Public Shelter Needs - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Public Shelter Needs (Individuals)	16
Displaced Households	20

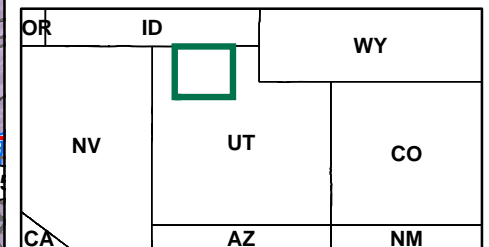
- 1 Dot = 1 Displaced Household*
- 1 Dot = 1 Public Shelter Need (Individual)*

* delineated by census tract

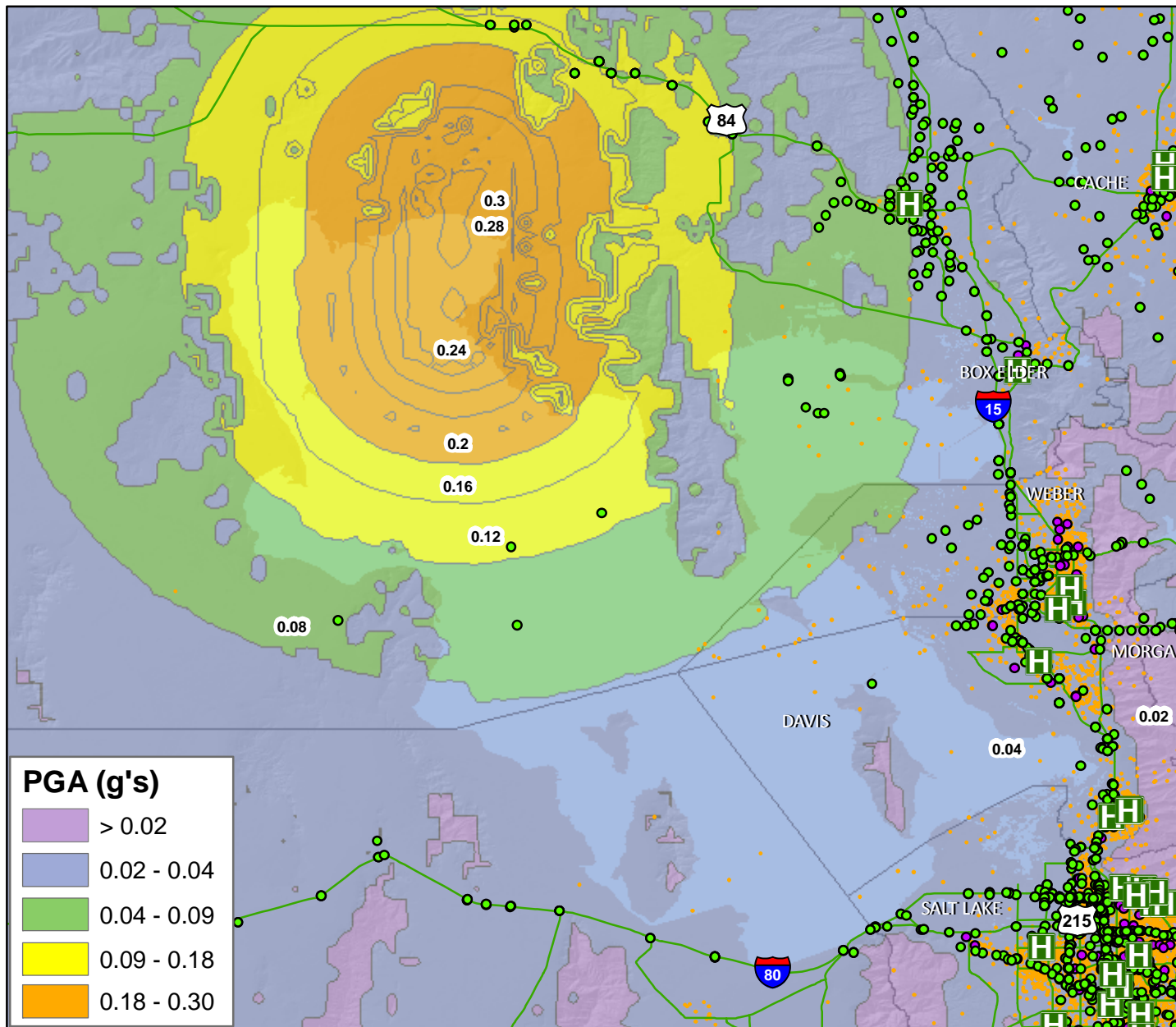
- Highways
- Roads
- Potential Fault Source
- Interstate
- Counties

0 5 10 15 20 25 30 Miles

10-19-09 FEMA & URS Corporation



Distribution of Elderly, Impaired Hospitals (Day 1), & Hospital Bed Availability - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Major Roadway Bridge Impact

- Low
- Moderate
- High

Highway Segment Impact

- Low
- Moderate
- High

Impaired Hospitals (Day 1)

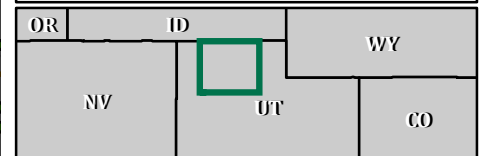
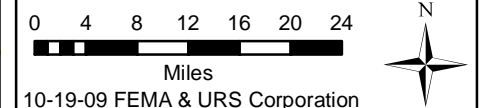
Damage is expressed as the probability that a given hospital will be at least moderately damaged.

- H Low
- H Moderate
- H High

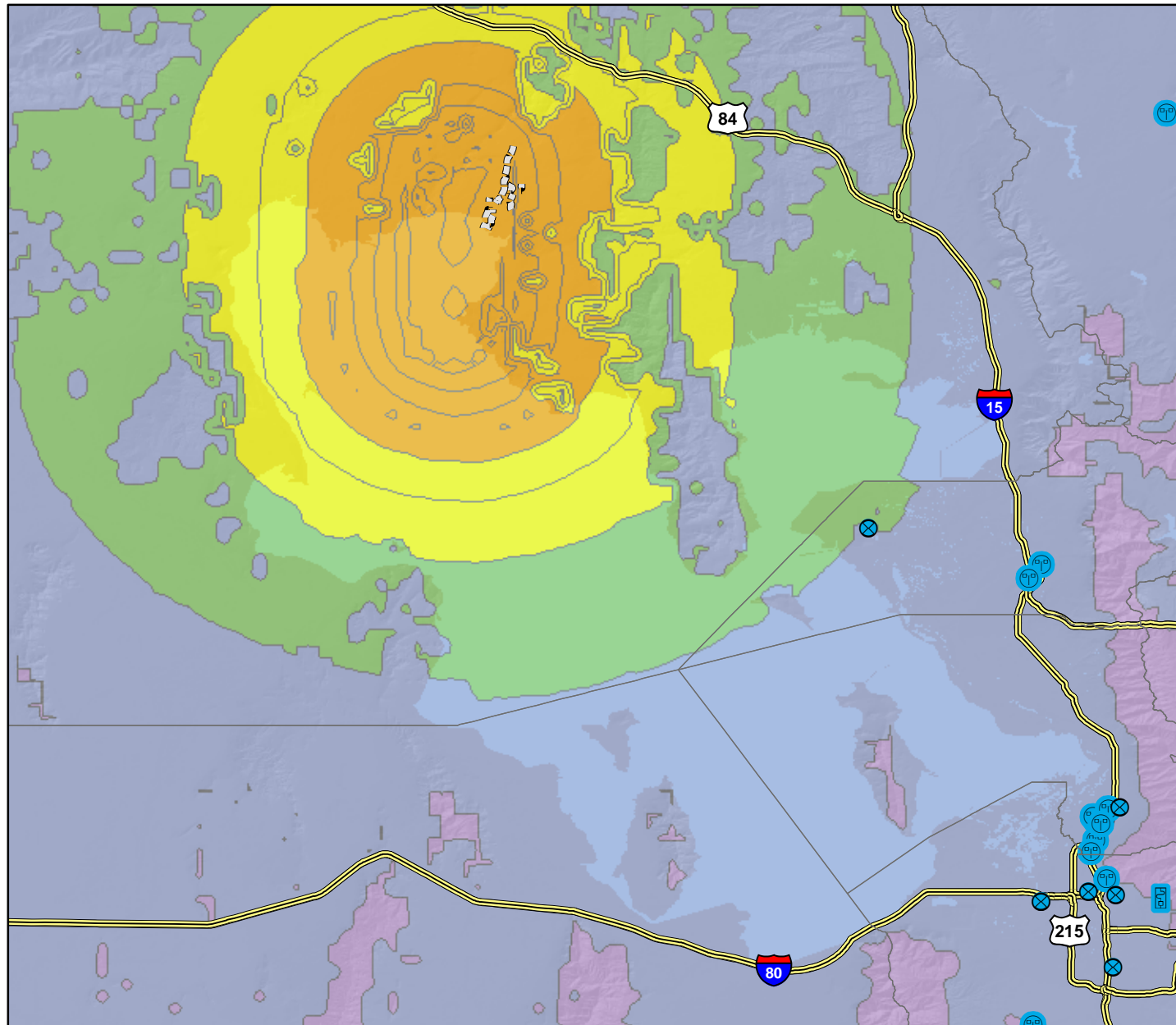
1 Dot = 30 People over 65

Nursing Home

County	Total # Hospital Beds	Hospital Beds Available	Injuries Requiring Hospital Treatment 2pm
Box Elder	107	107	2
Davis	468	468	0
Salt Lake	3,440	3,439	0
Uintah	118	118	0
Utah	39	39	0
Wasatch	1,013	1,013	0
Weber	655	655	0
Total	5,840	5,839	2



Electrical, Natural Gas, and Oil Facility Damage - Earthquake Scenario: Hansel Valley, UT

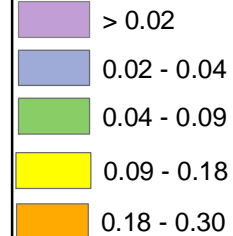


M6.6 Hansel Valley Earthquake

Utility Damage (at least moderate)

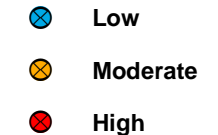
Damage is expressed as the probability that a given Utility System will realize at least moderate damage.

PGA (g's)

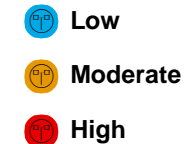


Counties
Fault Source
Interstate

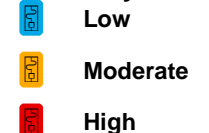
Electric Power Facility



Oil Facility



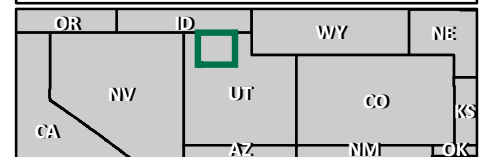
Natural Gas Facility



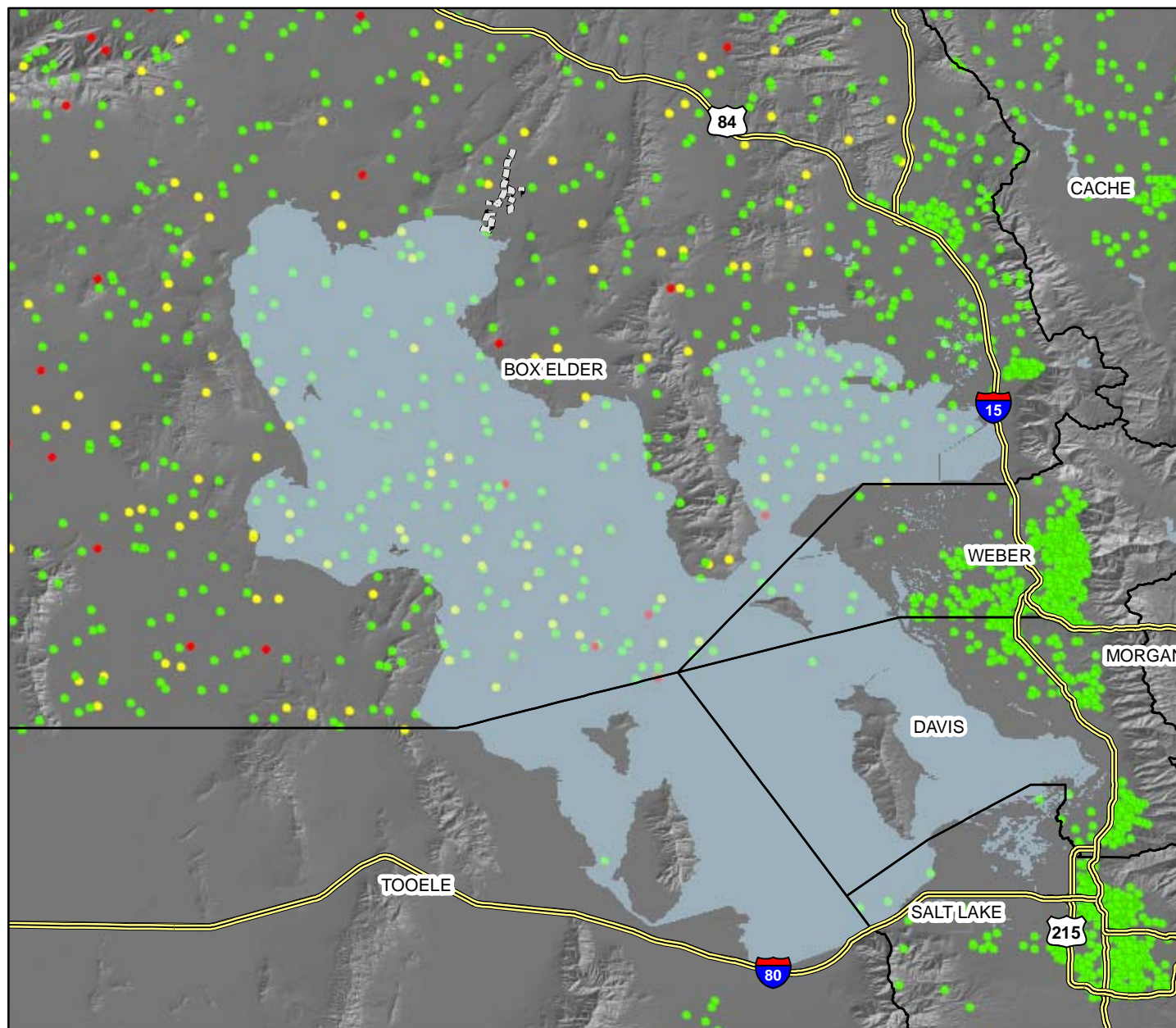
0 4 8 12 16 20 24

Miles

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Estimated Building Inspection Needs - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

	Estimated # of Structures	Estimated # of Inspectors Needed
Red (Complete)	30	1
Yellow (Extensive)	192	3
Light Green (Slight/Moderate)	2,041	14
Total	2,263	17

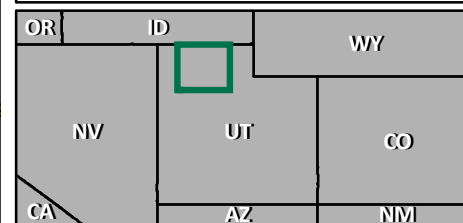
*Estimated number of inspectors needed to complete inspections in 30 days.

- 1 Dot = 1 (by census tract)
- Red Tag (Complete Damage)
- Yellow Tag (Extensive Damage)
- Green Tag (Slight/Moderate Damage)

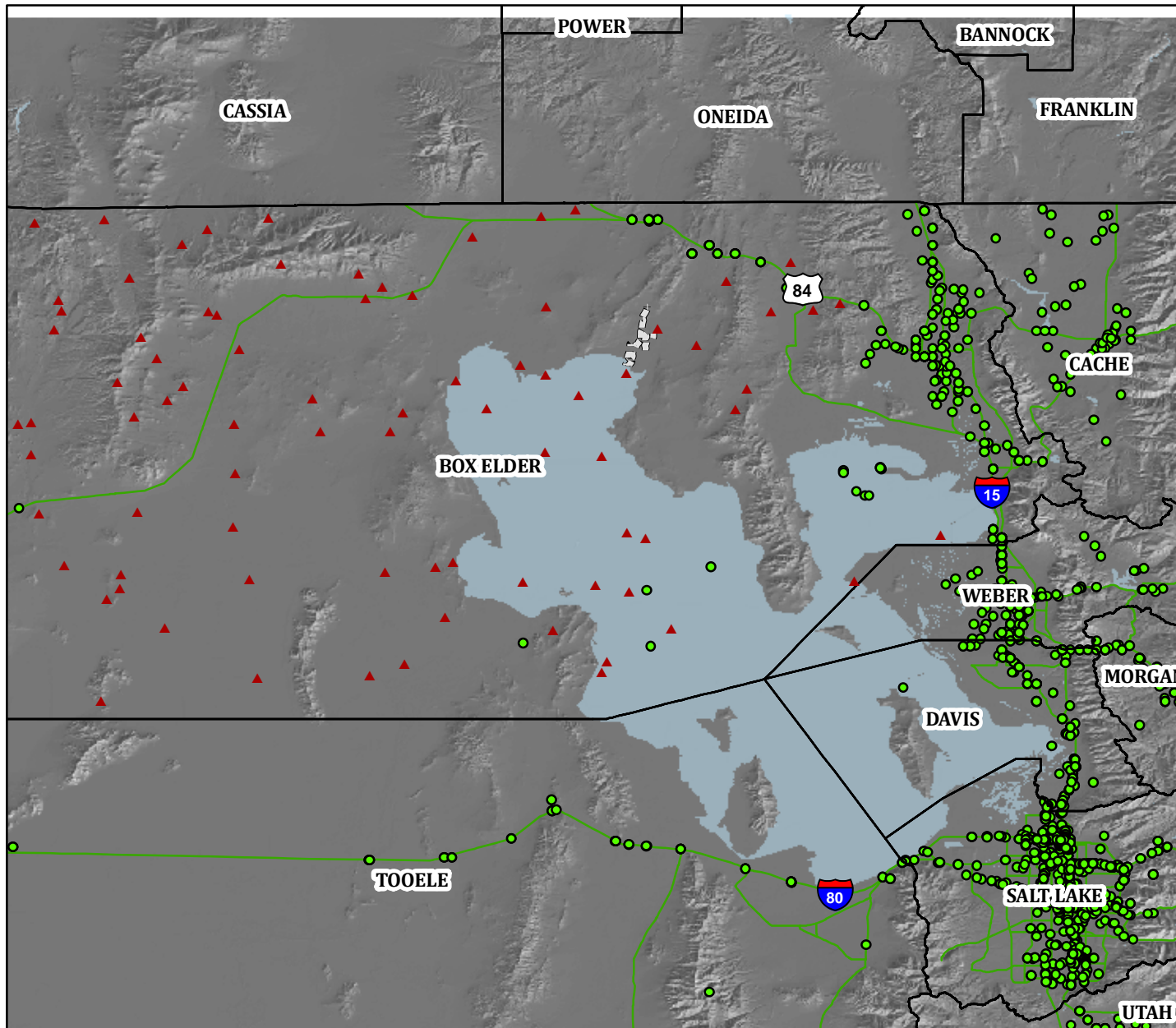
— Utah Interstates □ Counties
 □□□□ Fault Source

0 4 8 12 16 20 24
 Miles

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Estimated Debris and Highway Damage - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

1 Dot = 200 tons of
Concrete and Steel Debris
(by census tract)

Highway Damage

Damage is expressed as the probability that
a given bridge or highway segment will realize
at least moderate damage.

Highway Bridge Impact

- Low
- Moderate
- High

Highway Segment Impact

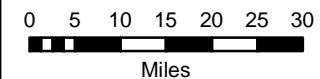
- Low
- Moderate
- High

□□□□ Fault Source

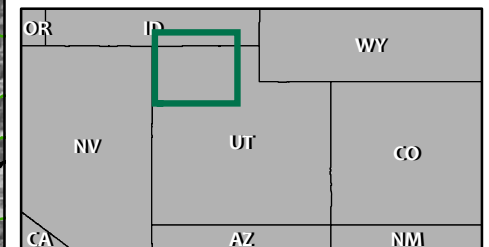
□ Counties

County	Brick and Wood (tons)	Concrete and Steel (tons)	Estimated Truck Loads*
Box Elder	13,000	17,000	1,200
Davis	1,000	0	40
Salt Lake	3,000	0	120
Weber	2,000	0	80
Total	19,000	17,000	1,440

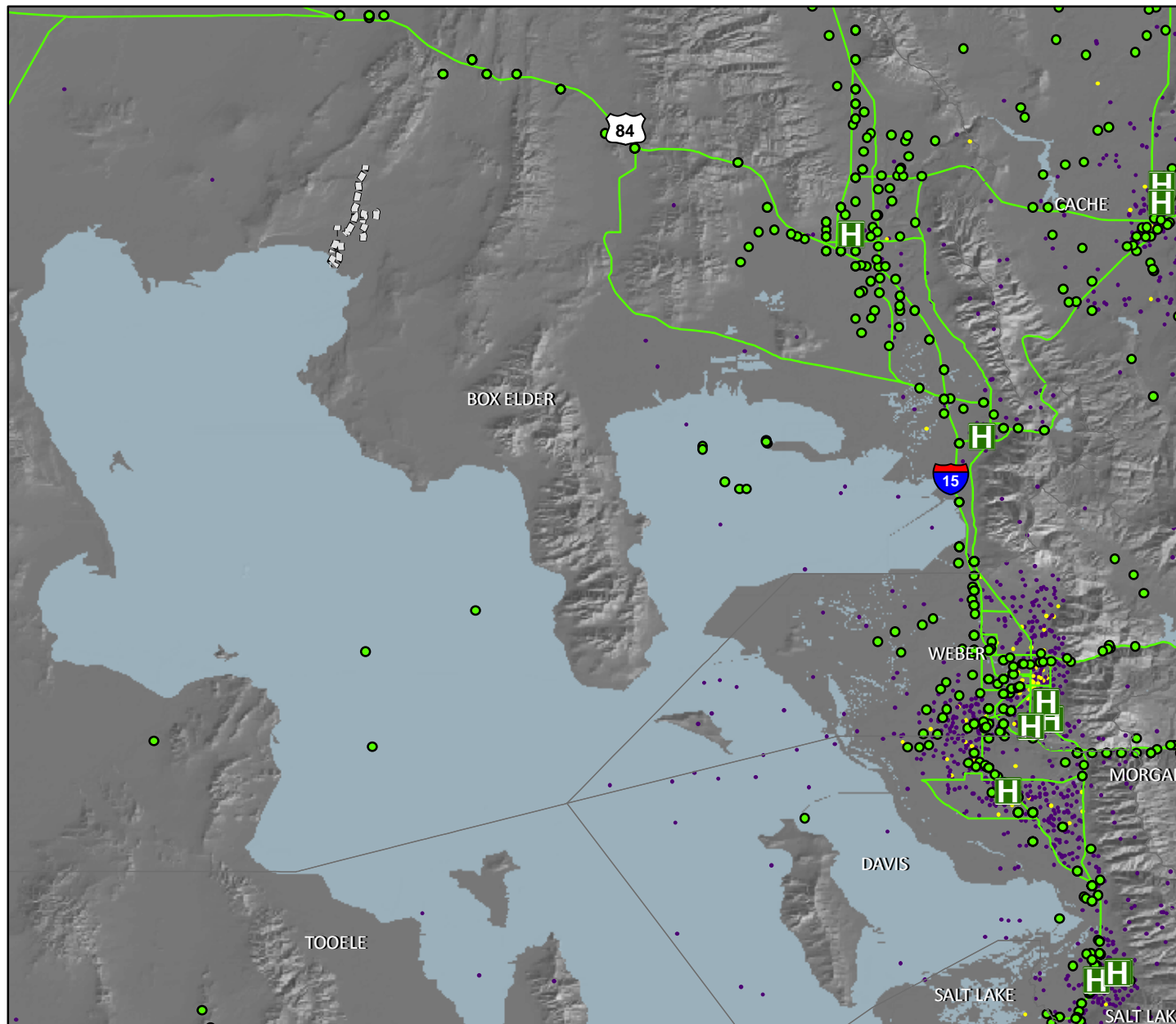
* Truck loads estimated at 25 tons per truck



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Demographic Distribution and Highway Functionality - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Major Roadway Bridge Impact

- Low
- Moderate
- High

Highway Segment Impact

- Low
- Moderate
- High

Demographics

1 Dot = 500 People (by census tract)

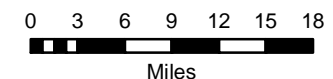
- English Speaking
- Potentially Non-English Speaking

Impaired Hospitals (Day 1)

Damage is expressed as the probability that a given hospital will be at least moderately damaged.

- H Low
- H Moderate
- H High

— Fault Source □ Counties

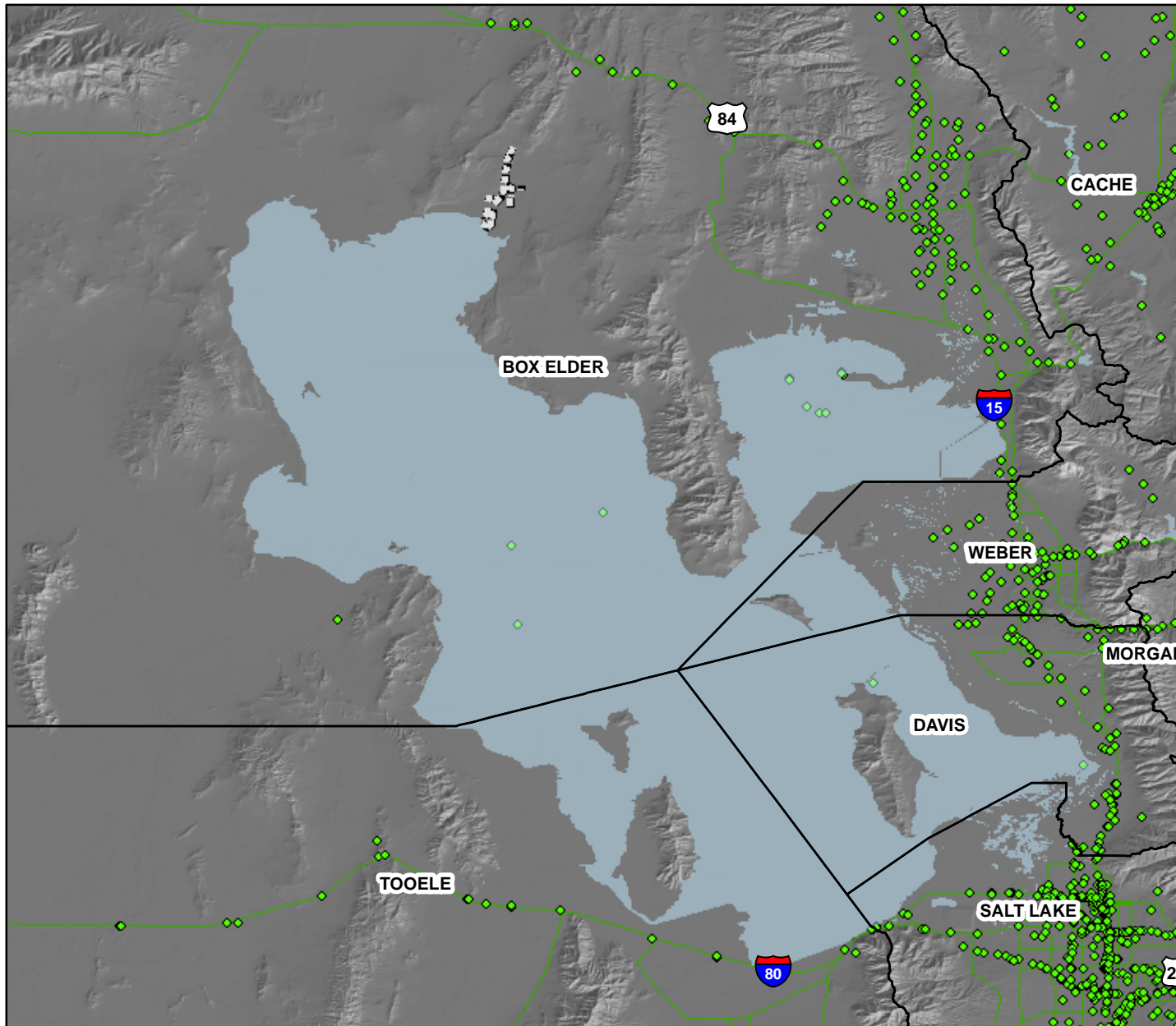


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ID		WY	
NV	UT	CO	

Estimated Highway Infrastructure Damage - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Major Roadway Bridge Impact

- Low
- Moderate
- High

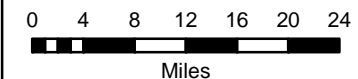
Highway Segment Impact

- Low
- Moderate
- High

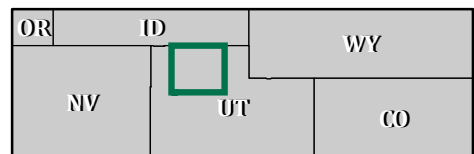
□□□□ Fault Source — Major Roads

County	# of Bridges Needing Inspection	# of Bridge Engineers Needed*
Box Elder	0	0
Cache	0	0
Davis	0	0
Salt Lake	0	0
Weber	0	0
Total	0	0

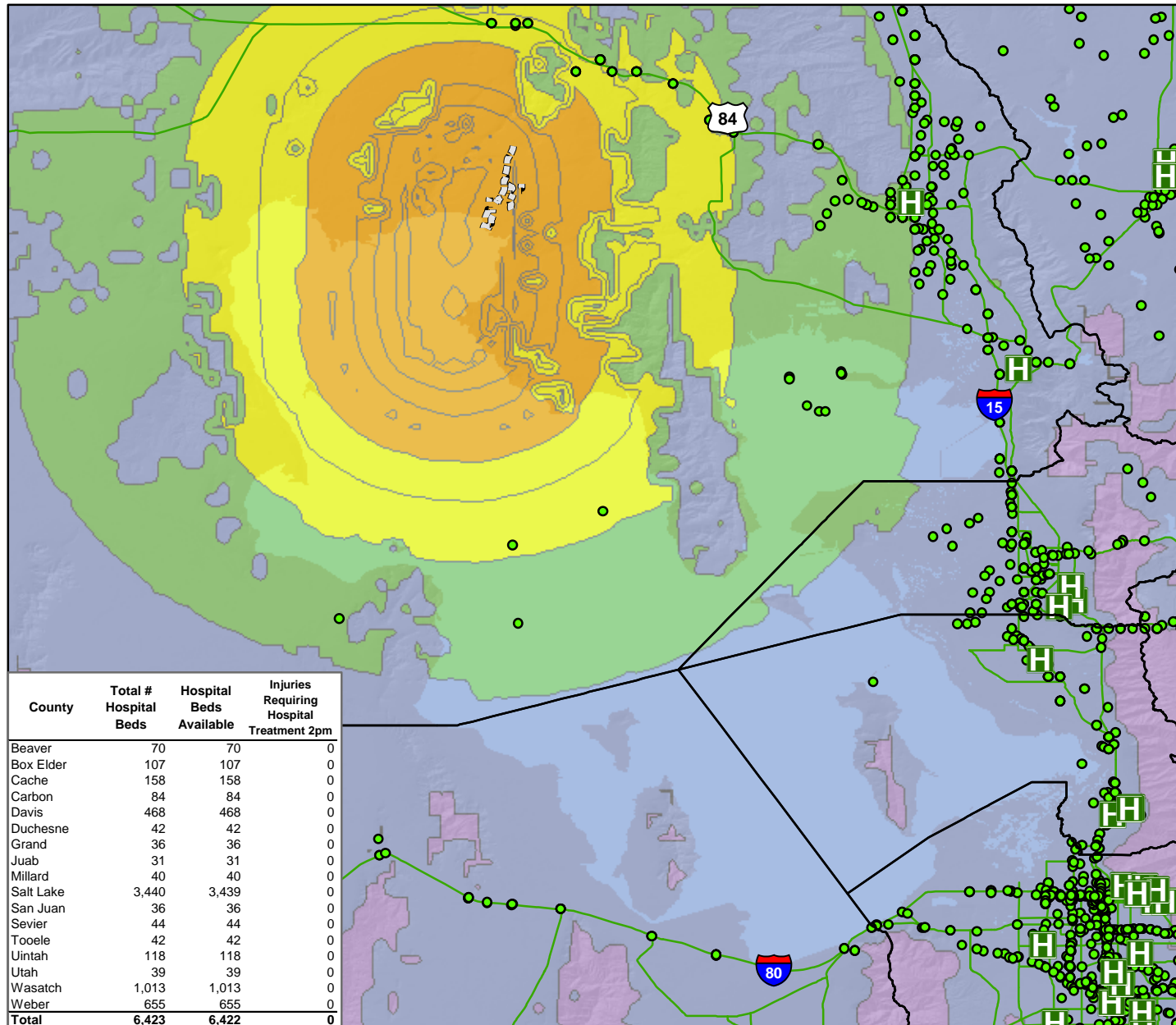
* 2 engineers can inspect 5 bridges a day for 3 days



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Impaired Hospitals (Day 1), Hospital Bed Availability, & Highway Functionality - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Major Roadway Bridge Impact

- Low
- Moderate
- High

Highway Segment Impact

- Low
- Moderate
- High

Impaired Hospitals (Day 1)

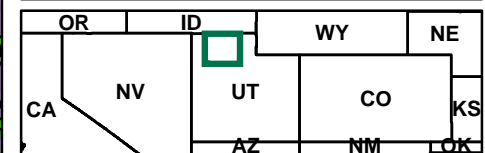
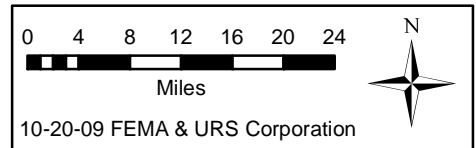
Damage is expressed as the probability that a given hospital will be at least moderately damaged.

- Low
- Moderate
- High

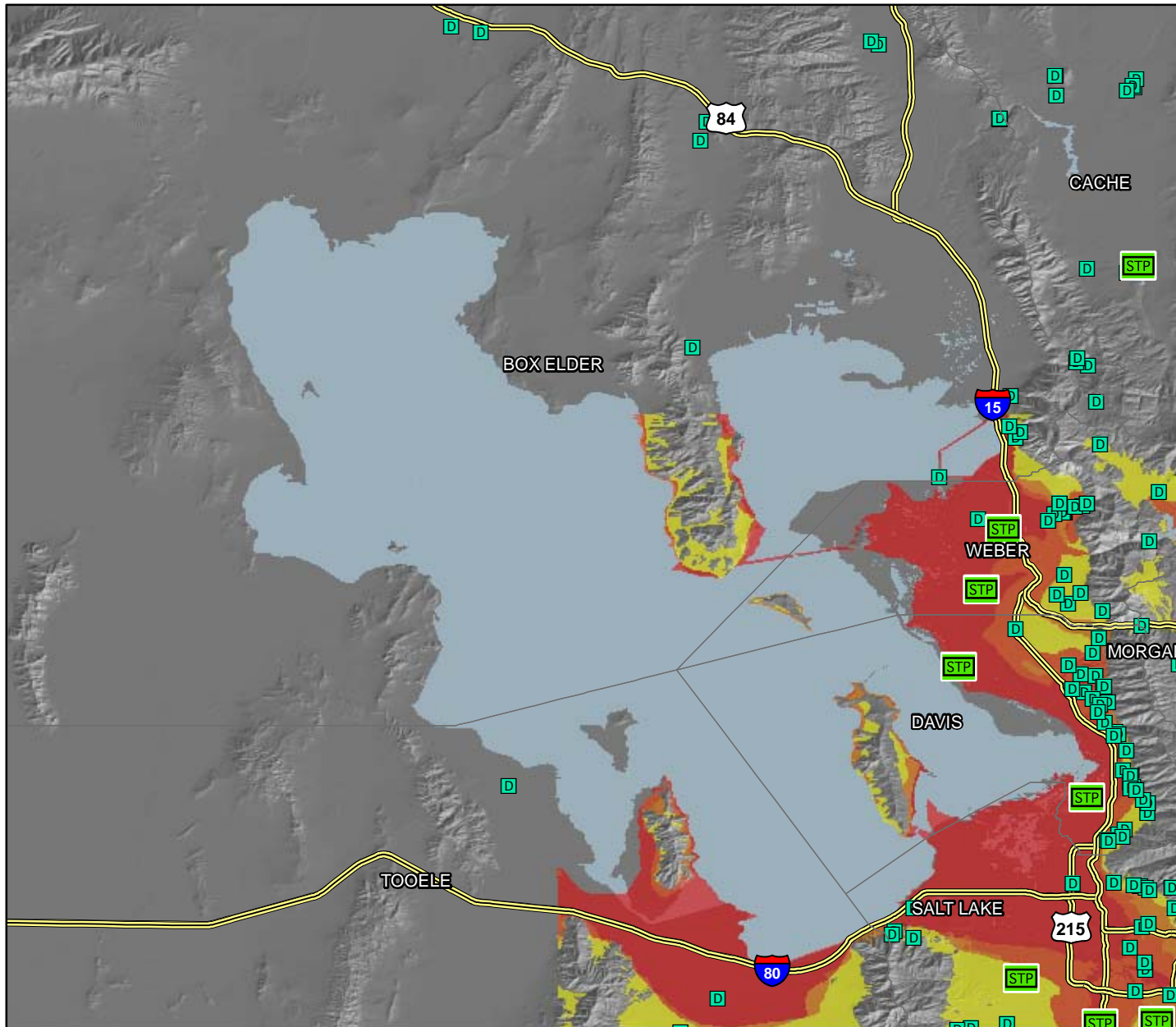
PGA (g's)

- > 0.02
- 0.02 - 0.04
- 0.04 - 0.09
- 0.09 - 0.18
- 0.18 - 0.30

□ Counties
□□□□ Fault Source



Water Line, Sewage Treatment Facility Distribution and Liquefaction Susceptibility - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Liquefaction Susceptibility



Interstates

Sewage Treatment Facilities

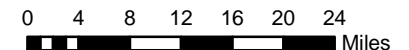
Dams

Counties

County	# Households without Potable Water (at Day 1)	Daily Potable Water Needs Per Person (Gallons/day)	Number of Truckloads needed Daily
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Box Elder	7,969	23,907	5
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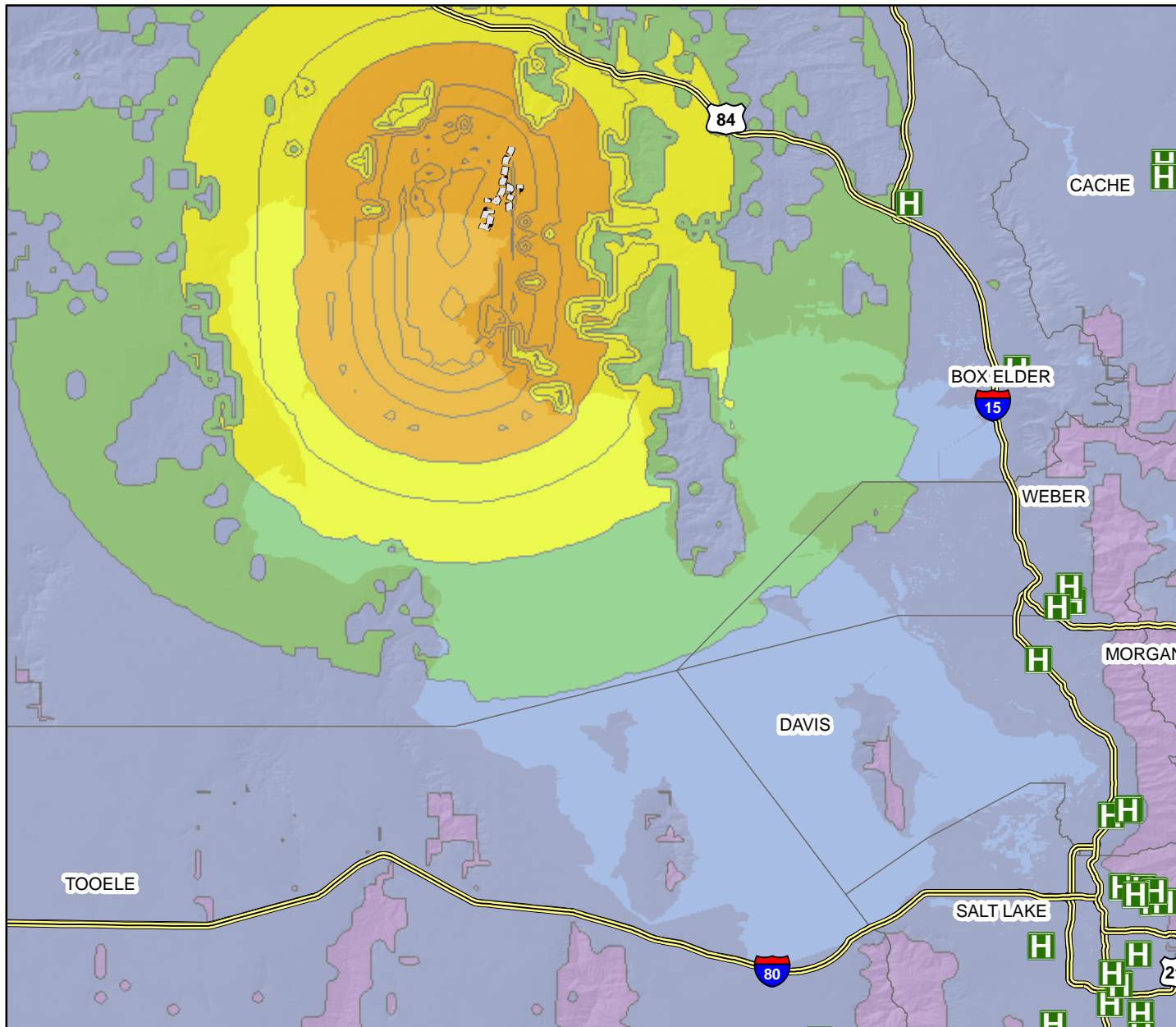
* Based on U.S. Army Corp Mission Guidebook
(Daily water is based on an estimated 3 people per household.
One truck can transport an estimated 5000 gallons of water.)



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OR	ID	WY	
NV	UT	CO	
CA	AZ	NM	

Potential Search and Rescue Needs - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Impaired Hospital (Day 1)

Damage is expressed as the probability that a given hospital will be at least moderately damaged.

H Low
H Moderate
H High

1 Dot = 1 Life Threatening Injury (Severity Level 3* - 2pm)

Injuries Requiring Hospital Treatment (2 PM)	Immediate Life Threatening Injuries
7	1

Structure Type	Red (Complete)	Collapse Rates for Complete Damage	Total Collapse
Wood	0	3%	0
Steel	3	6%	0
Concrete	1	10%	0
Precast	1	13%	0
Reinforced Masonry	1	10%	0
Unreinforced Masonry	22	15%	3
Manufactured Housing	2	3%	0
Total	30		4

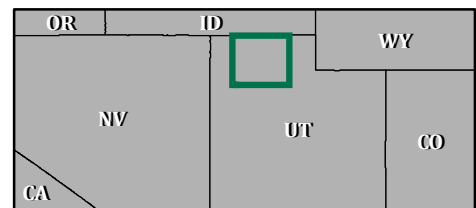
*Severity Level 3 is defined as injuries that require hospitalization and can become life threatening if not promptly treated.

□□□□ Fault Source □ Counties

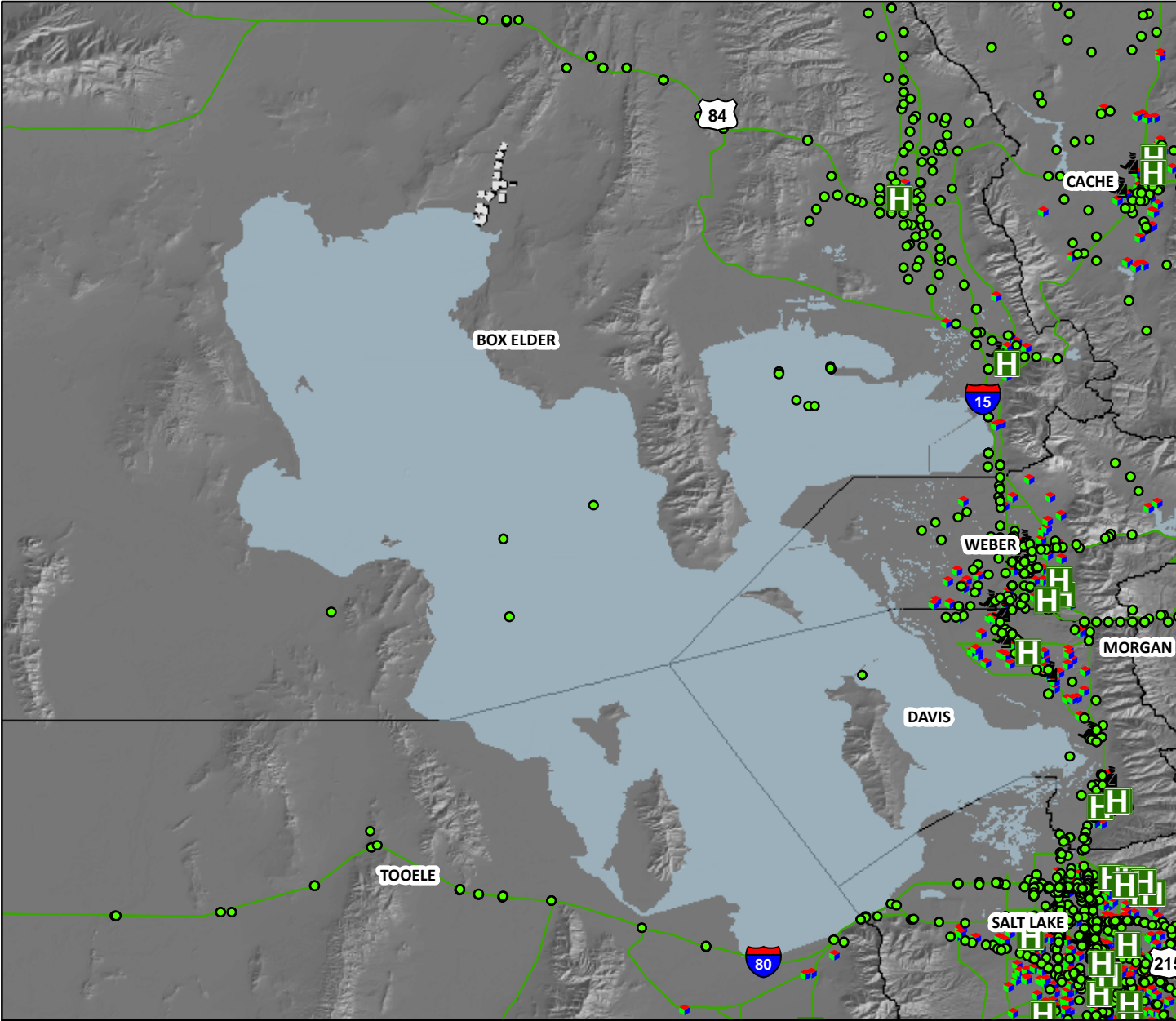
0 3 6 9 12 15 18 Miles



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Correctional and Daycare Facilities, Impaired Hospitals (Day 1), and Highway Functionality - Earthquake Scenario: Hansel Valley, UT



M6.6 Hansel Valley Earthquake

Highway Damage

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Damage is expressed as the probability that a given bridge or highway segment will realize at least moderate damage.

Major Roadway Bridge Impact

- Low (Green circle)
- Moderate (Yellow circle)
- High (Red circle)




Highway Segment Impact

- Low (Green line)
- Moderate (Yellow line)
- High (Red line)


- Low
- Moderate
- High



Impaired Hospitals (Day 1)

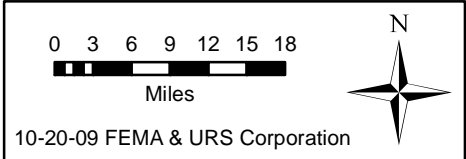
Damage is expressed as the probability that a given hospital will be at least moderately damaged.

	Low
	Moderate
	High

Damage is expressed as the probability that a given hospital will be at least moderately damaged.

-  Low
 Moderate
 High

-  Correctional Facilities
 -  Daycare Facilities



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