Earthquakes in Nevada

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There are huge risks.

We can take action to reduce the risks.

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Nevada Department of Public Safety
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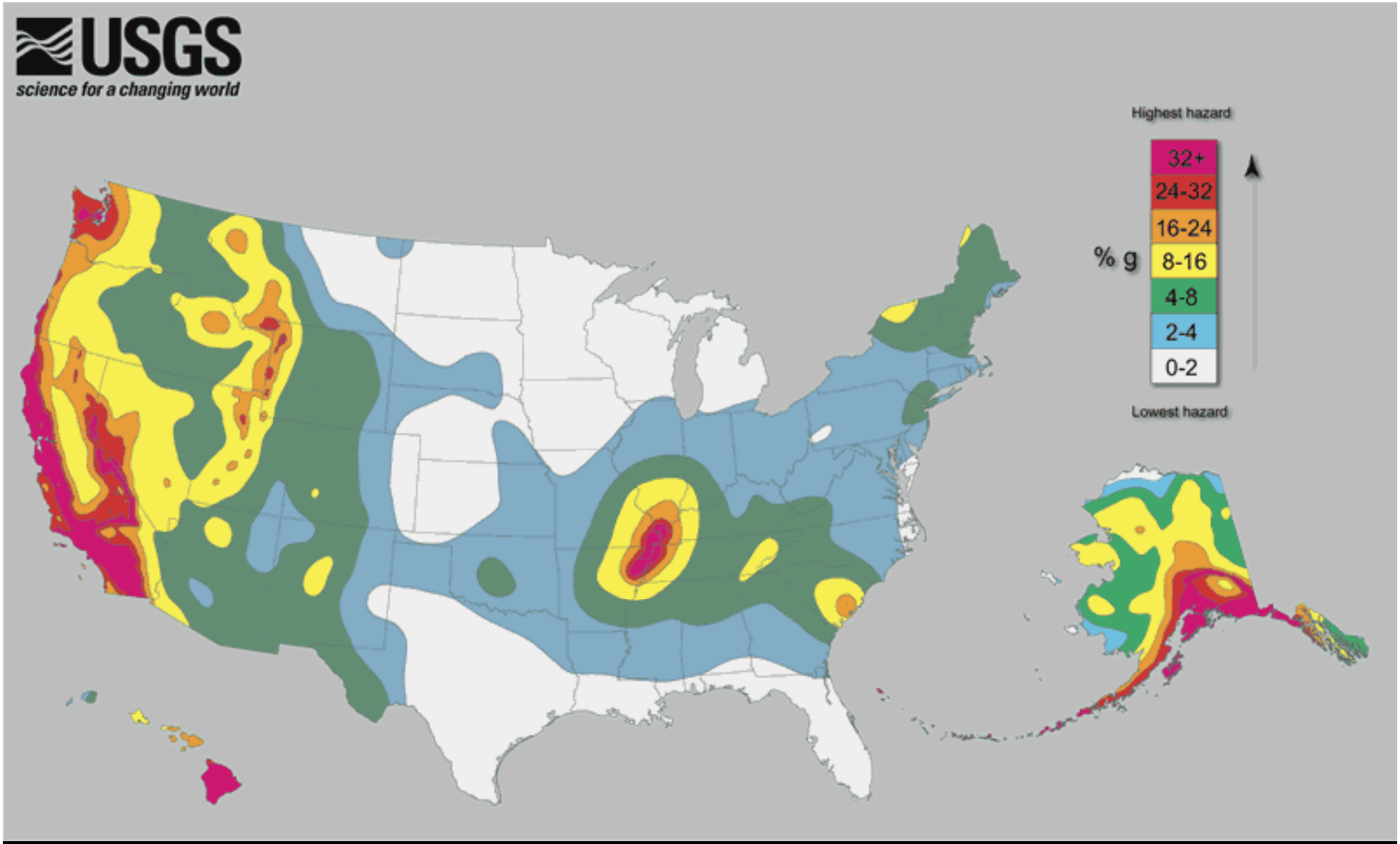


Hazard: probabilities of earthquakes occurring.

The big concerns are largely in western states.

Probability of a Magnitude 6.5 or Greater Earthquake in the Next 50 Years

FROM: http://earthquake.usgs.gov/

Denver, CO ~0.1%

Phoenix and Tucson, AZ <1%

Spokane, WA = 1.0 to 1.5%

Flagstaff, AZ ~2%

Boise, ID ~2%

El Paso, TX ~2%

Albuquerque, NM = 4 to 5%

Fresno, CA <5%

Portland, OR ~5%

Yuma, AZ = 5 to 10%

Bozeman, MT ~10%

Cedar City, UT ~9%

Sacramento, CA ~15%

Jackson, WY = 15 to 20%

Salt Lake City, UT = 20 to 25%

San Diego, CA ~25%

Seattle, WA ~30%

Monterey, CA ~40%

Eureka, CA ~50%

Santa Barbara, CA = ~60%

San Francisco Bay Area = 70 to 90%

Los Angeles Metropolitan Area = 60 to >90%

Ely, NV = 1.5 to 2%

Pioche, NV = 2 to 3%

Eureka, NV = 4 to 6%

Las Vegas & Pahrump, NV <5%

Goldfield & Winnemucca, NV = 5 to 10%

Elko, NV = 6 to 8%

Battle Mountain & Lovelock, NV ~10%

Austin, NV = 10 to 15%

Fallon, NV = 20 to 25%

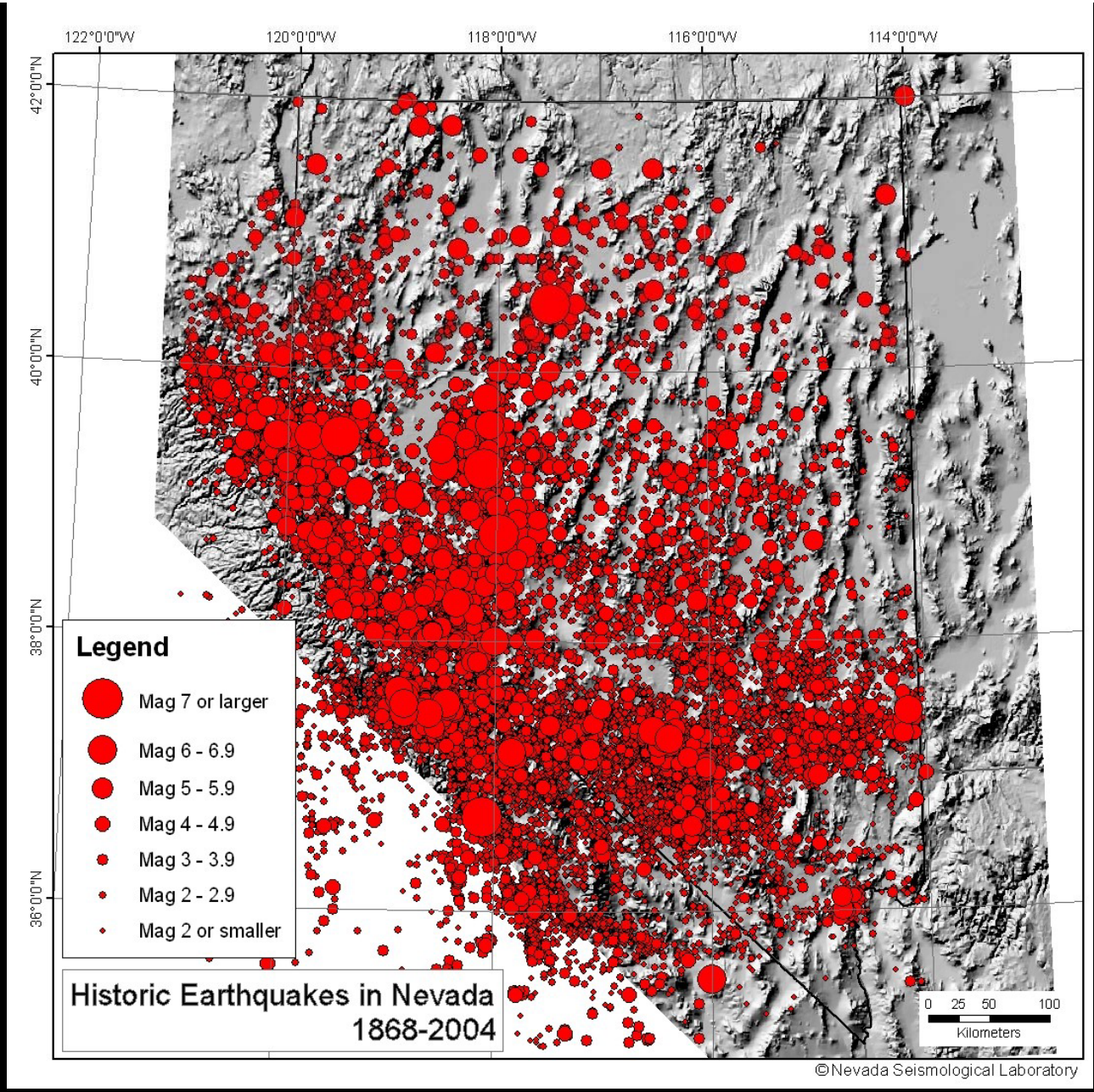
Beatty, NV = 20 to 30%

Hawthorne, NV = 30 to 40%

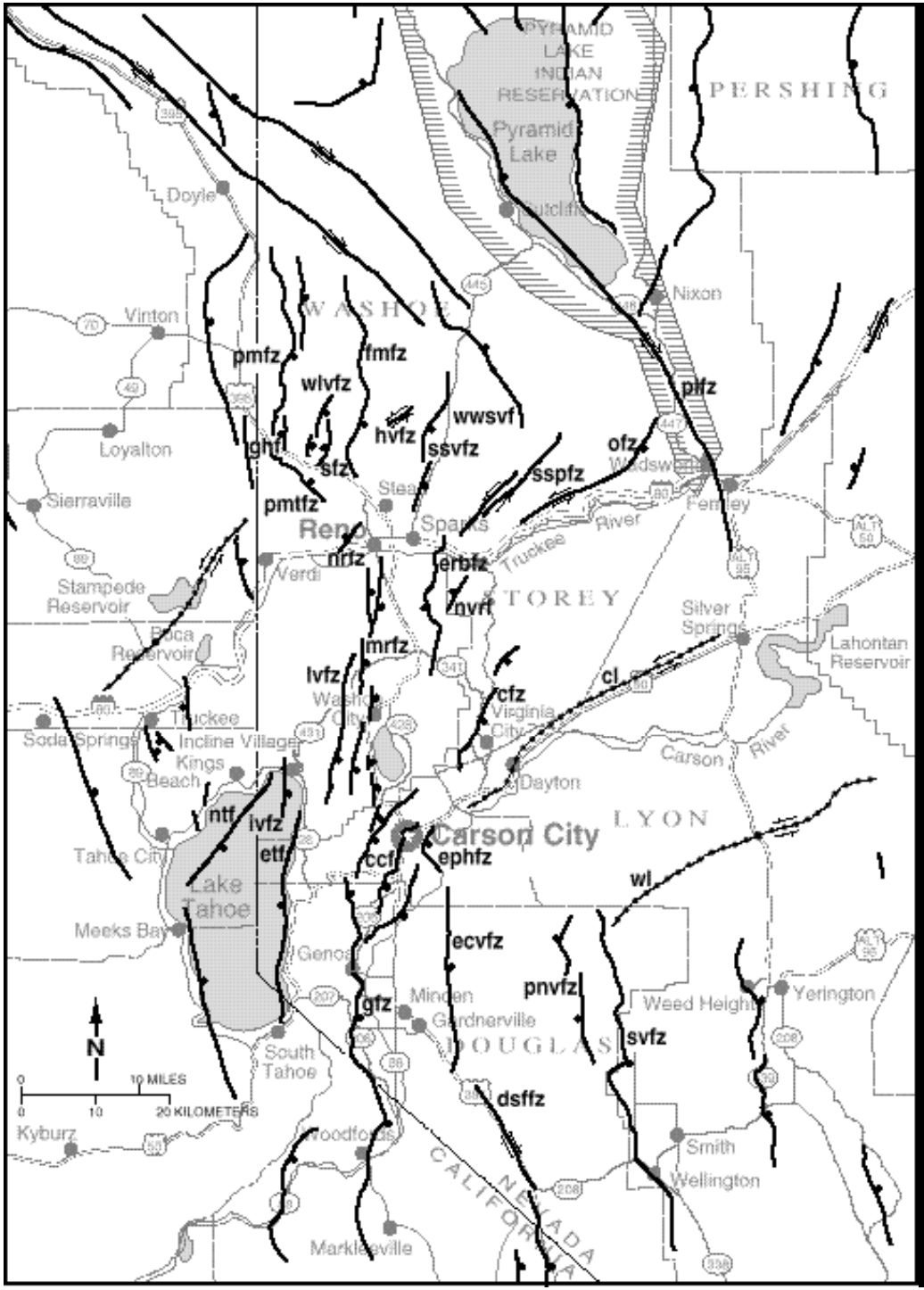
Yerington, NV = 40 to 45%

South Lake Tahoe, CA + Stateline, NV ~45%

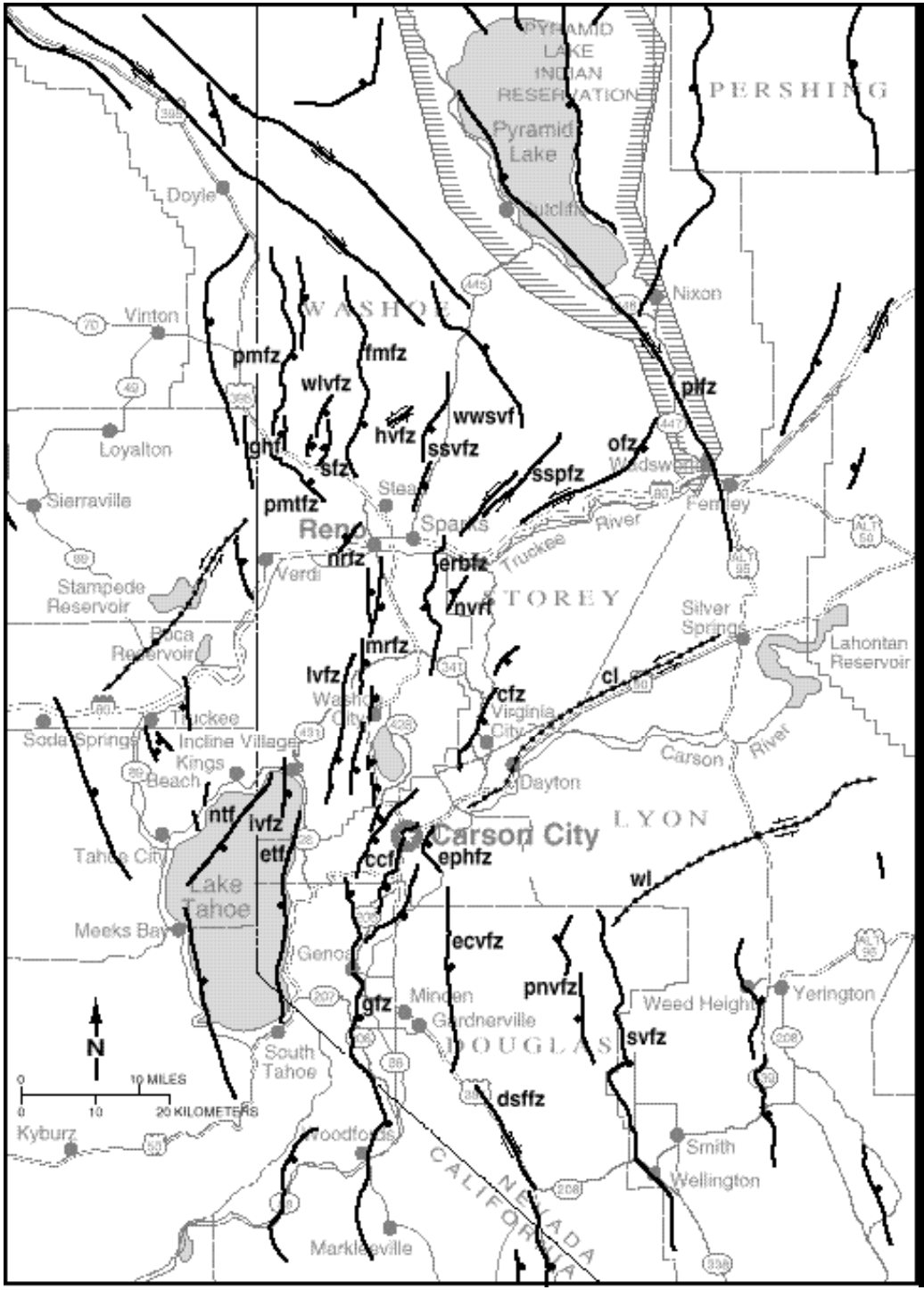
Reno–Carson City–Minden-VA City = 50 to 60%



Earthquakes have occurred throughout Nevada.



There is a good chance that you will experience a major earthquake. There are at least 30 faults that could cause damage in the Reno-Carson City urban corridor.



The probability of at least one magnitude 6.5 or greater event in the next fifty years is between 50 and 60% for the Reno-Carson City-Minden urban area area.

Hazards include intense ground shaking, ruptures of the ground, liquefaction, landslides, and ancillary problems, such as fires and hazardous waste spills.

We used FEMA's loss-estimation model, HAZUS-MH, to estimate the effects of potential earthquakes near each of the county seats in Nevada.

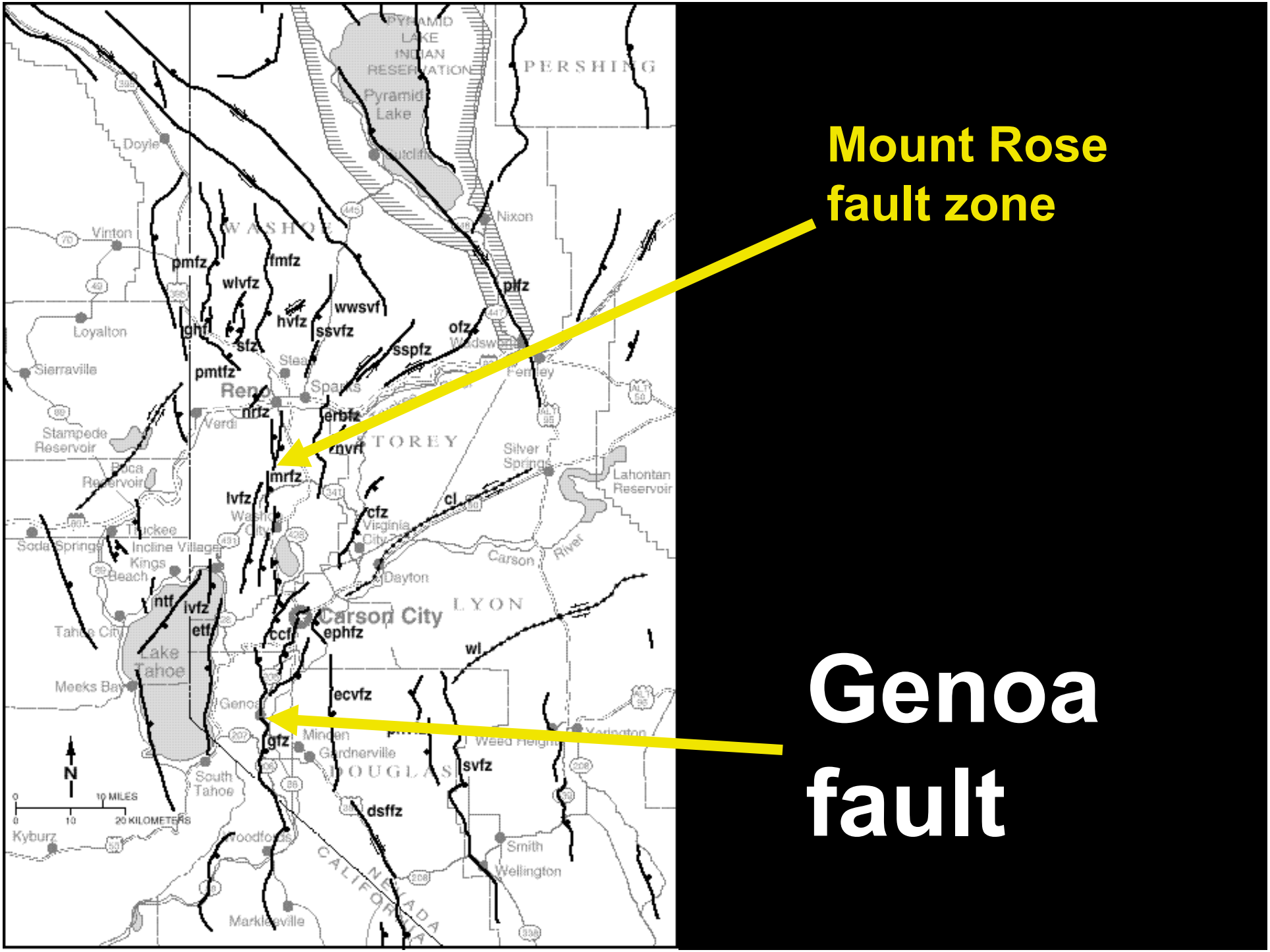
This model is used in emergency-response and recovery exercises and will be used to help rapidly estimate the scope of damage and losses immediately after an earthquake (information that helps with a Presidential Declaration of Disaster).

Nevada Bureau of Mines and Geology
Open-File Report 06-1
www.nbmg.unr.edu

FEMA used this model in 2000 to estimate annualized loss from earthquakes: $55 million per year for the State, including $28 million per year for the Las Vegas area, and $18 million per year for the Reno area.

But major earthquakes in Nevada don't occur annually. They happen on any given fault every few thousand to tens of thousands of years. If an earthquake occurs soon near an urban area, the consequences can be devastating.

Because Nevada has so many active faults, the hazards are high, and the risks are huge.


Mount Rose fault zone
Genoa fault
pmfz
fmfz
wlvfz
wwsvf
hvfz
ssvfz
ghf
sfz
sspfz
ofz
plfz
pmtfz
nrfz
erbfz
znvrf
mrfz
lvfz
cfz
cl
ntf
ivfz
etf
ccf
ephfz
wl
ecvfz
gfz
svfz
dsffz
Reno
Sparks
Carson City
Lake Tahoe
Pyramid Lake
Truckee
Incline Village
Dayton
Virginia City
Silver Springs
Fernley
Yerington
Minden
Gardnerville
Smith
Wellington
Markleeville
Kyburz
Loyalton
Sierraville
Vinton
Doyle
Nixon
Stampede Reservoir
Boca Reservoir
Lahontan Reservoir
Carson River
Meeks Bay
South Tahoe
Kings Beach
Soda Springs
Tahoe City
Verdi
Weed Heights
PERSHING
WASHOE
STOREY
LYON
DOUGLAS
CALIFORNIA
NEVADA
PYRAMID LAKE INDIAN RESERVATION
N
0 10 MILES
0 10 20 KILOMETERS


up to 5 meters of vertical displacement when it last moved, ~ 550 years ago


one of the most active faults in Nevada

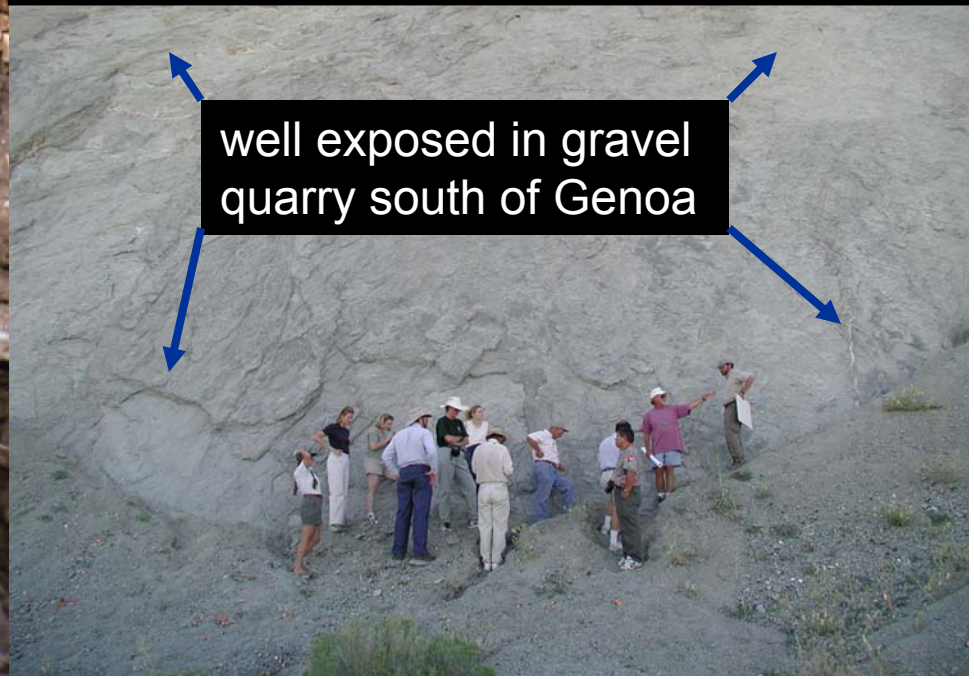
Genoa fault


well exposed in gravel quarry south of Genoa


up to 5 meters of vertical displacement when it last moved, ~ 550 years ago


one of the most active faults in Nevada

Genoa fault


well exposed in gravel quarry south of Genoa

The risks are huge.

For a magnitude 7.1 earthquake on the Genoa fault, HAZUS estimated, for the Washoe-Carson-Storey-Douglas region:

up to $2.5 billion in economic loss
(~$471 million in Douglas County alone)

major damage to approximately 3,600 buildings

600 to 3,000 displaced households

150 to 600 people needing public shelter

The risks are huge.

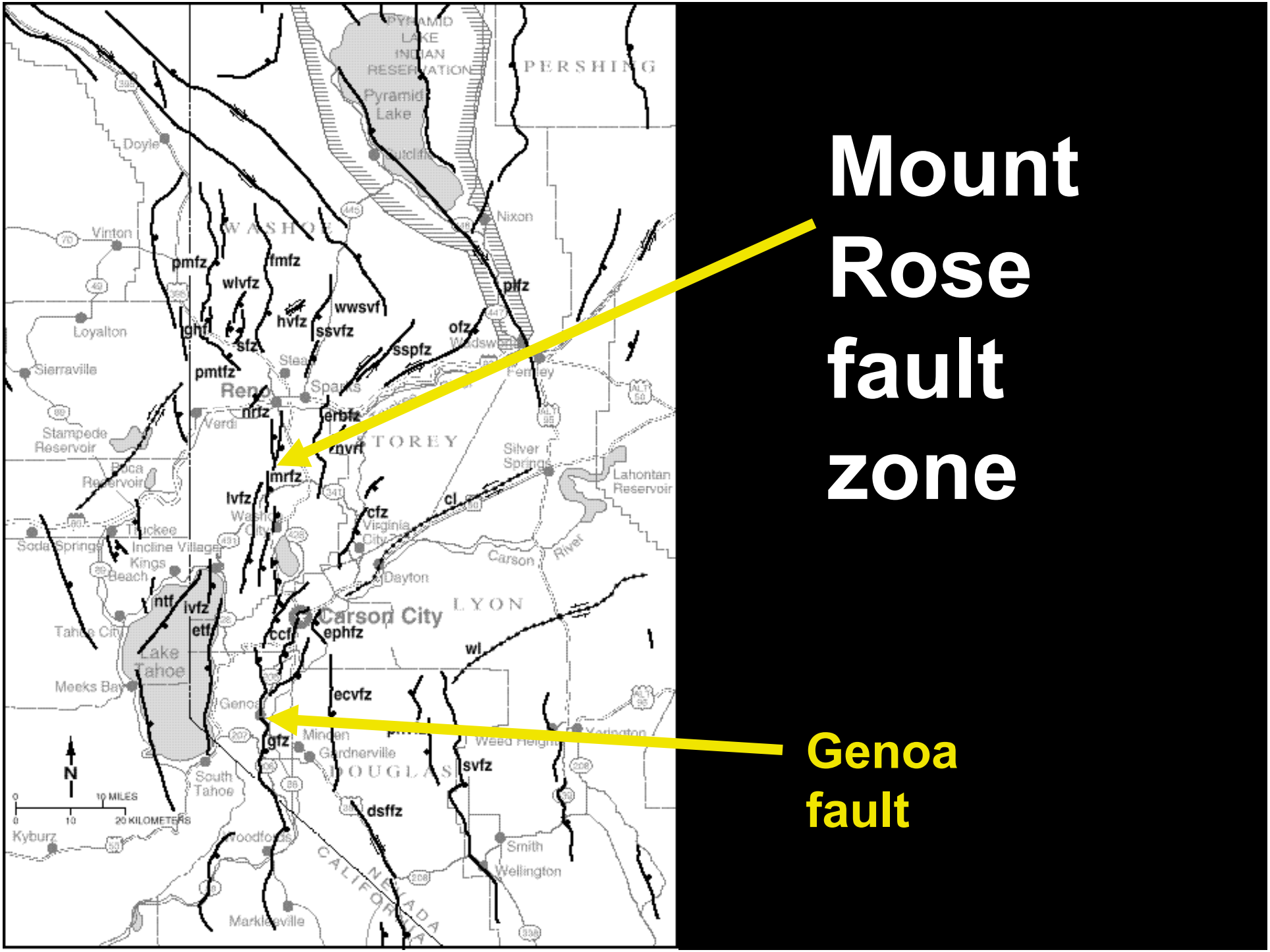
For a magnitude 7.1 earthquake on the Genoa fault, HAZUS estimated, for the Washoe-Carson-Storey-Douglas region:

400 to 1,500 people needing medical aid

100 to 400 people needing hospital care

20 to 60 life-threatening injuries

30 to 120 fatalities.


Mount Rose fault zone
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hvfz
ssvfz
sfz
sspfz
ofz
pmtfz
nrfz
erbfz
znvrf
mrfz
lvfz
cfz
cl
ntf
ivfz
etf
ccf
ephfz
wl
ecvfz
gfz
svfz
dsffz
Carson City
LYON
DOUGLAS
Reno
Sparks
Lake Tahoe
Pyramid Lake
PERSHING
WASHOE
STOREY
Virginia City
Dayton
Carson River
Silver Springs
Lahontan Reservoir
Stampede Reservoir
Truckee
Incline Village
Kings Beach
Tahoe City
Meeks Bay
South Tahoe
Minden
Gardnerville
Smith
Wellington
Markleeville
Kyburz
Loyalton
Sierraville
Vinton
Doyle
Nixon
Fernley
Verdi
N
0 10 MILES
0 10 20 KILOMETERS

The risks are huge.

For a magnitude 6.9 earthquake on the Mount Rose fault, HAZUS estimated, for the Washoe-Carson-Storey-Douglas region:

up to $7.6 billion in economic loss
(~2.9 billion in Washoe County alone)

major damage to approximately 12,000 buildings

3,000 to 12,000 displaced households

800 to 3,000 people needing public shelter

The risks are huge.

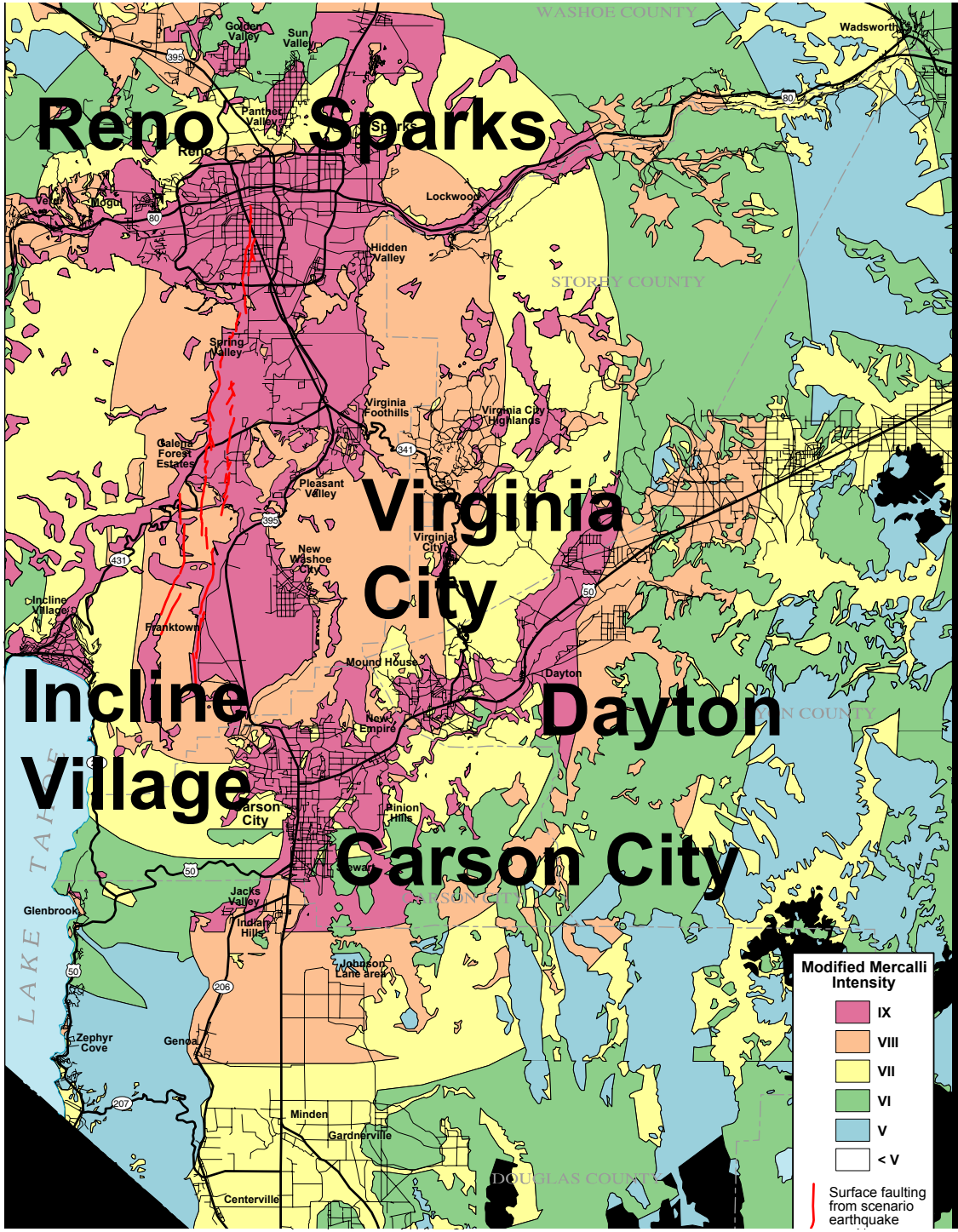
For a magnitude 6.9 earthquake on the Mount Rose fault, HAZUS estimated, for the Washoe-Carson-Storey-Douglas region:

1,300 to 5,000 people needing medical aid

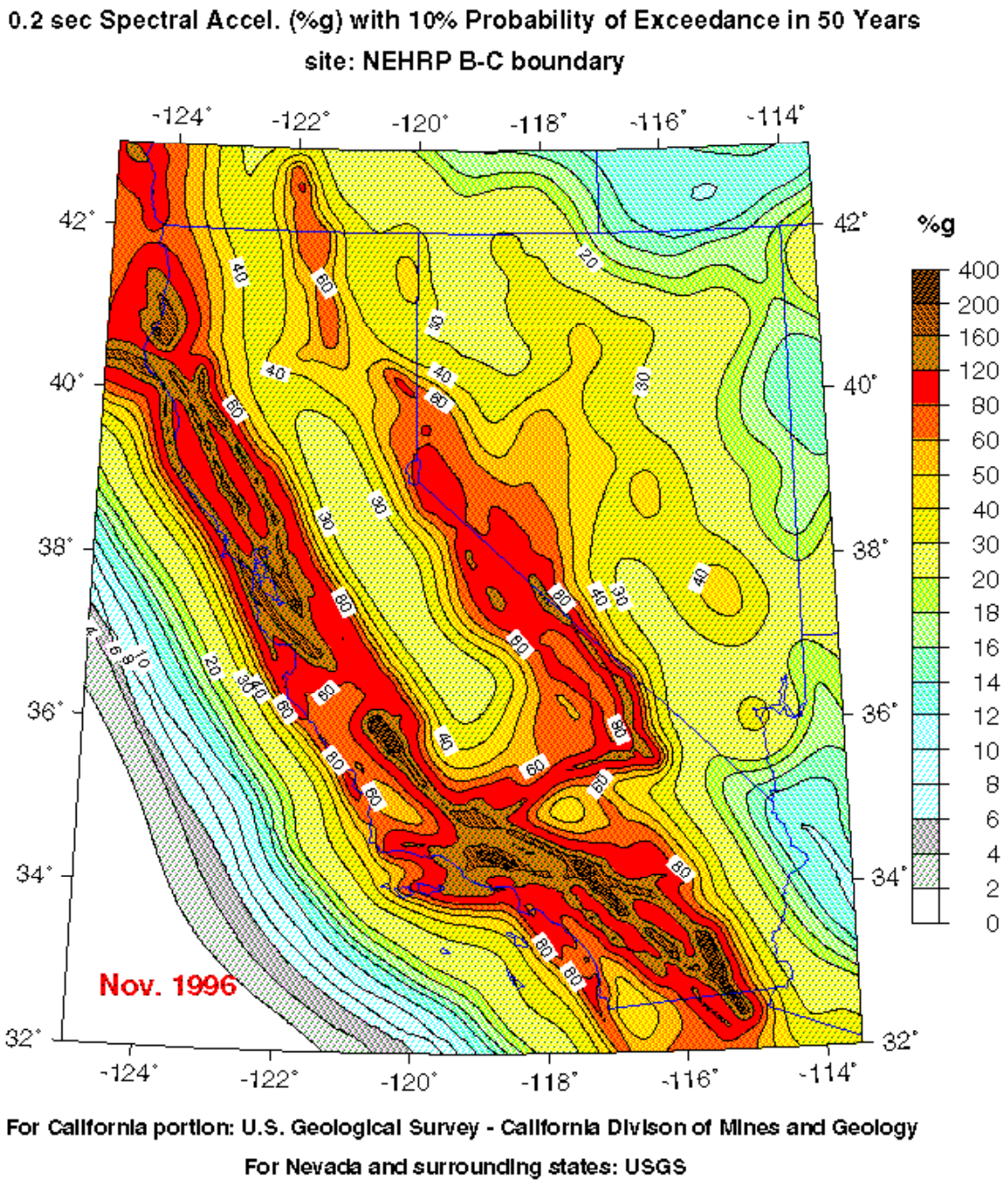
400 to 1,500 people needing hospital care

60 to 120 people with life-threatening injuries

120 to 500 fatalities.



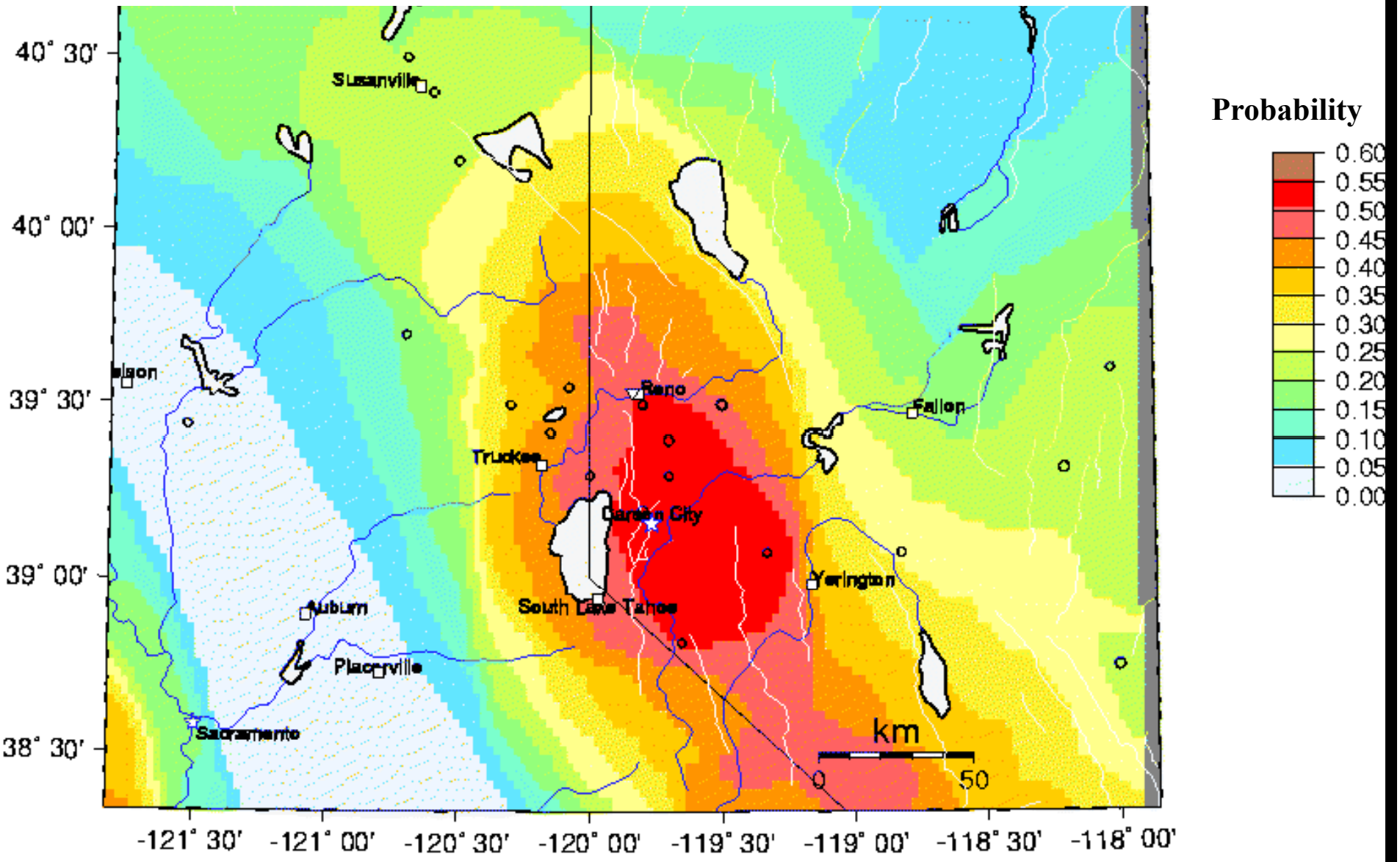
Modified Mercalli Intensity Map from NBMG's 1996 "Planning Scenario for a Major Earthquake in Western Nevada" – A magnitude 7.1 earthquake on the Mt. Rose fault could cause **widespread damage in the area of Intensity IX ("General panic. Cracked ground conspicuous. Damage considerable in specially designed structures, great in substantial masonry buildings with some collapse in large part.")**

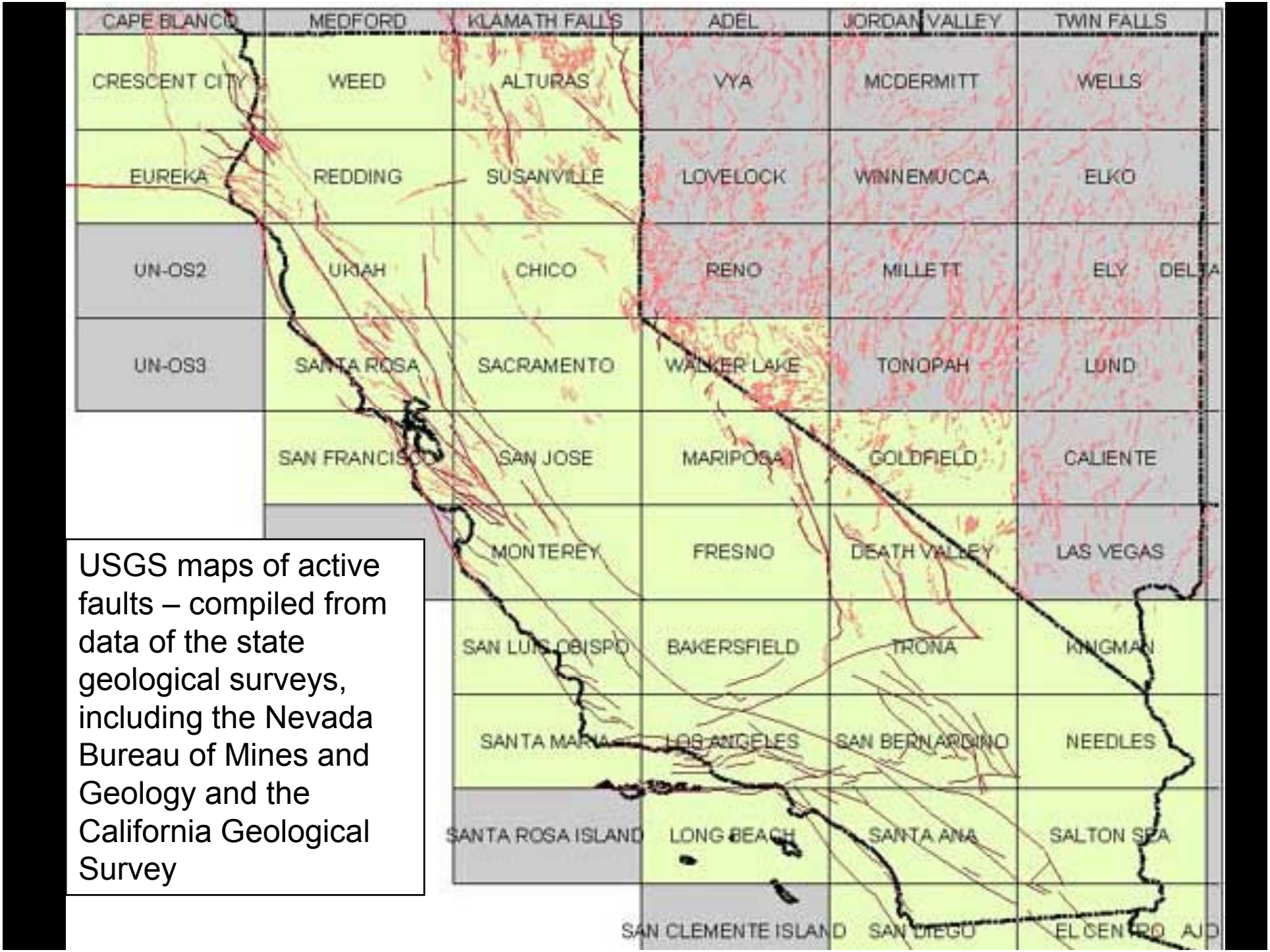


The earthquake hazards in Nevada are comparable to those in seismically active areas of California.

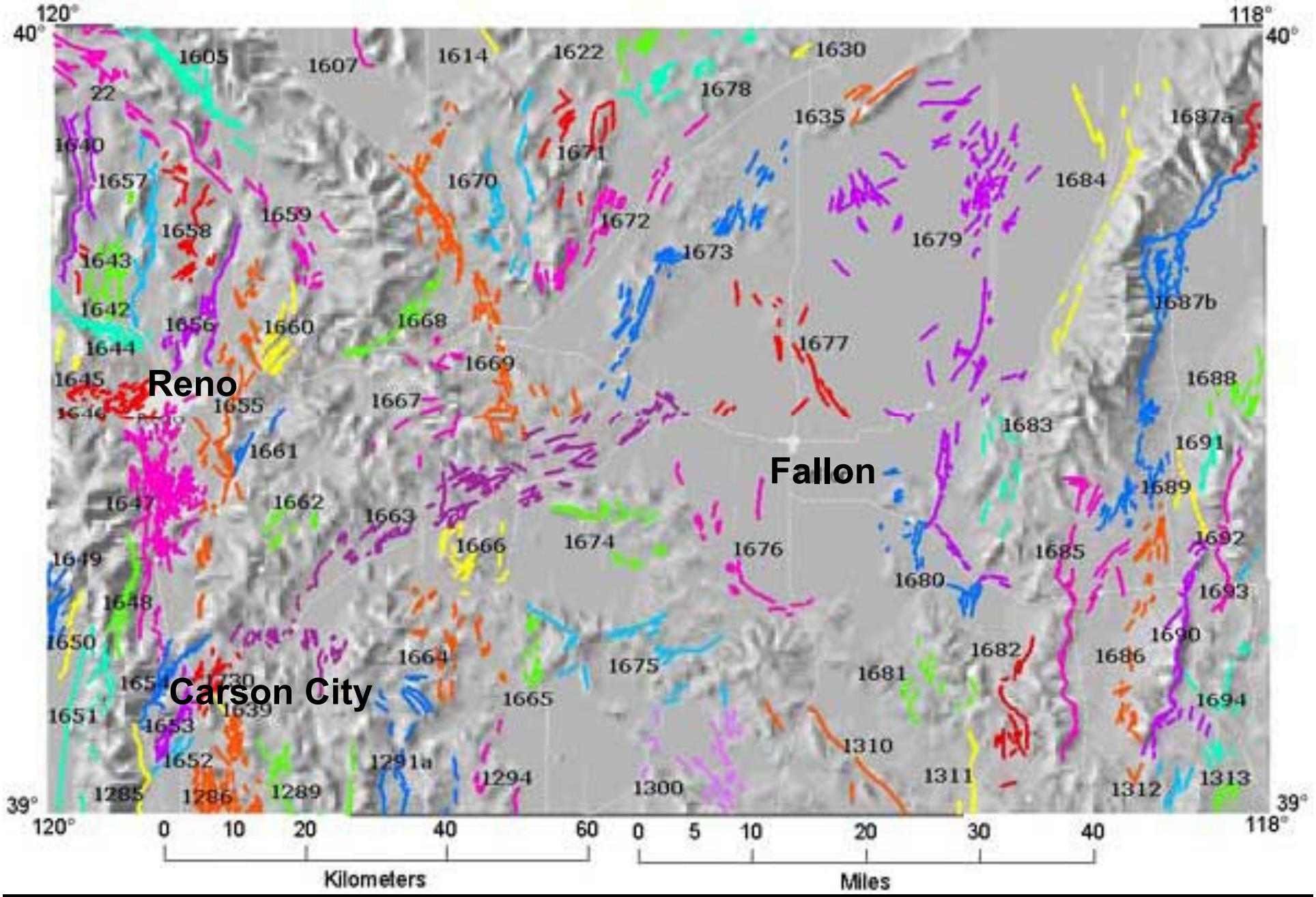
Probability of an earthquake of magnitude 6.5 or greater occurring within 50 km in 50 years (from USGS probabilistic seismic hazard analysis)

~50% chance for Reno and Carson City, magnitude 6.5





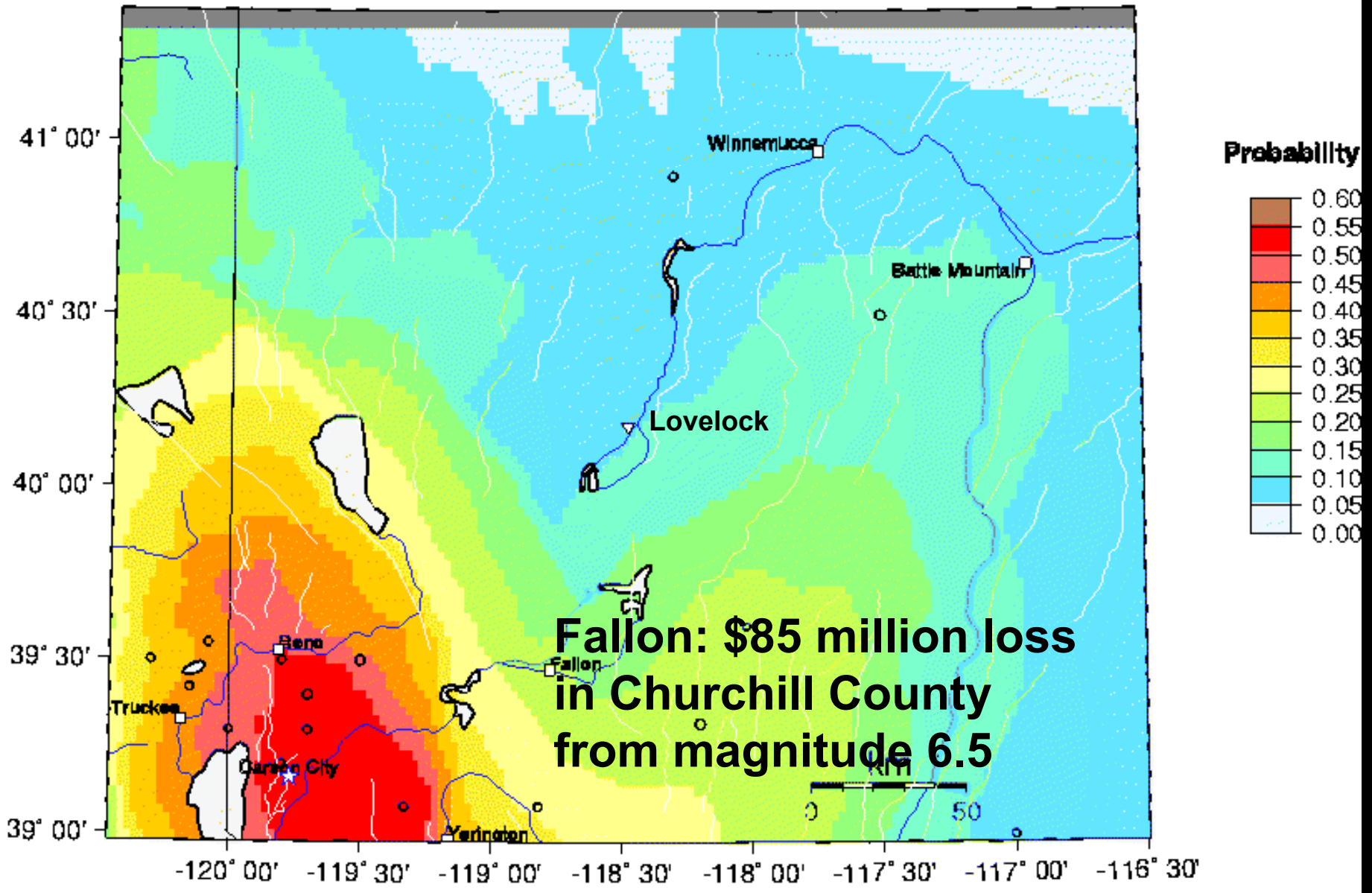
USGS maps of active faults – compiled from data of the state geological surveys, including the Nevada Bureau of Mines and Geology and the California Geological Survey

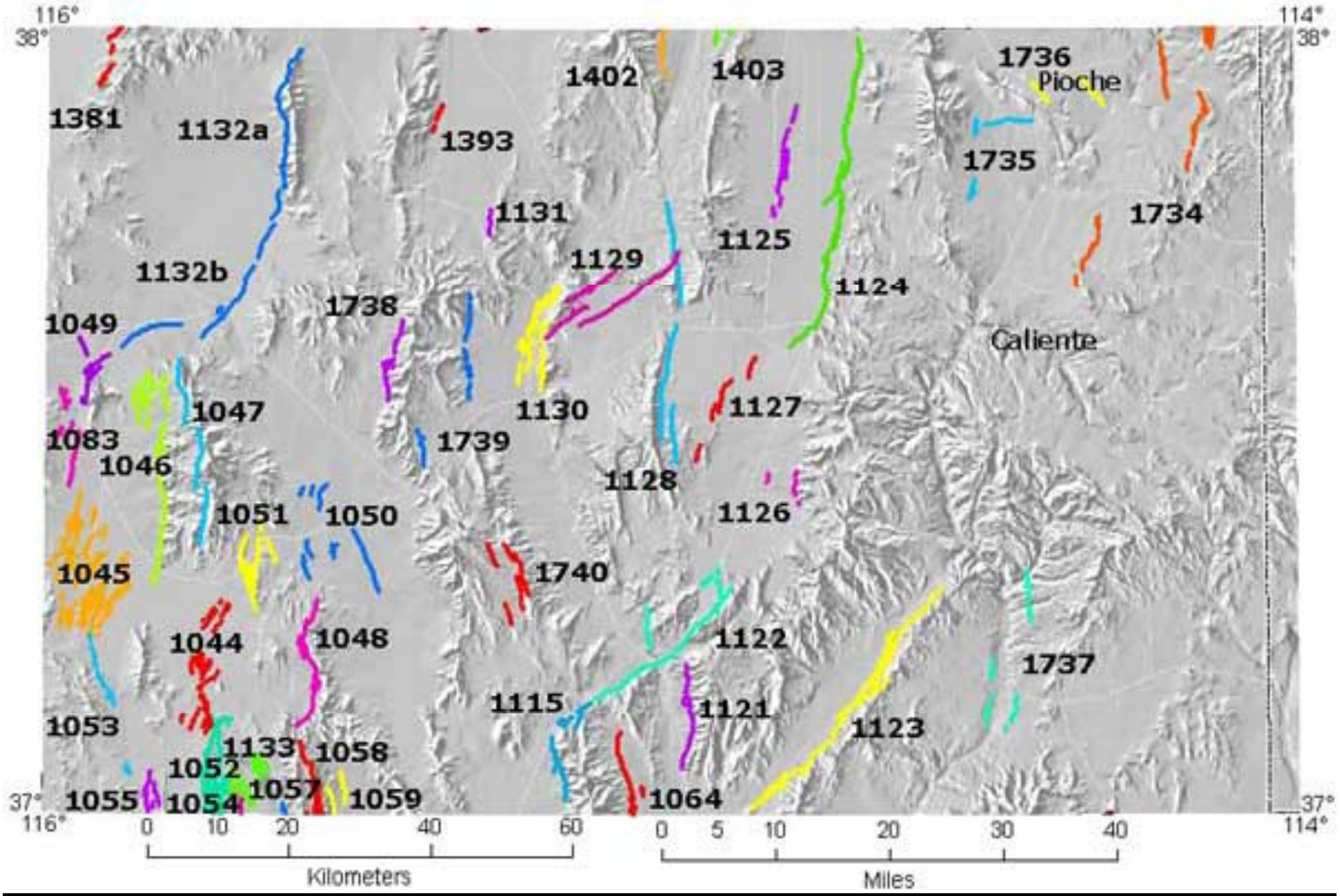


Active faults on the Reno 1 x 2-degree sheet

Probability of an earthquake of magnitude 6.5 or greater occurring within 50 km in 50 years (from USGS probabilistic seismic hazard analysis)

20-25% chance for Fallon, magnitude 6.5

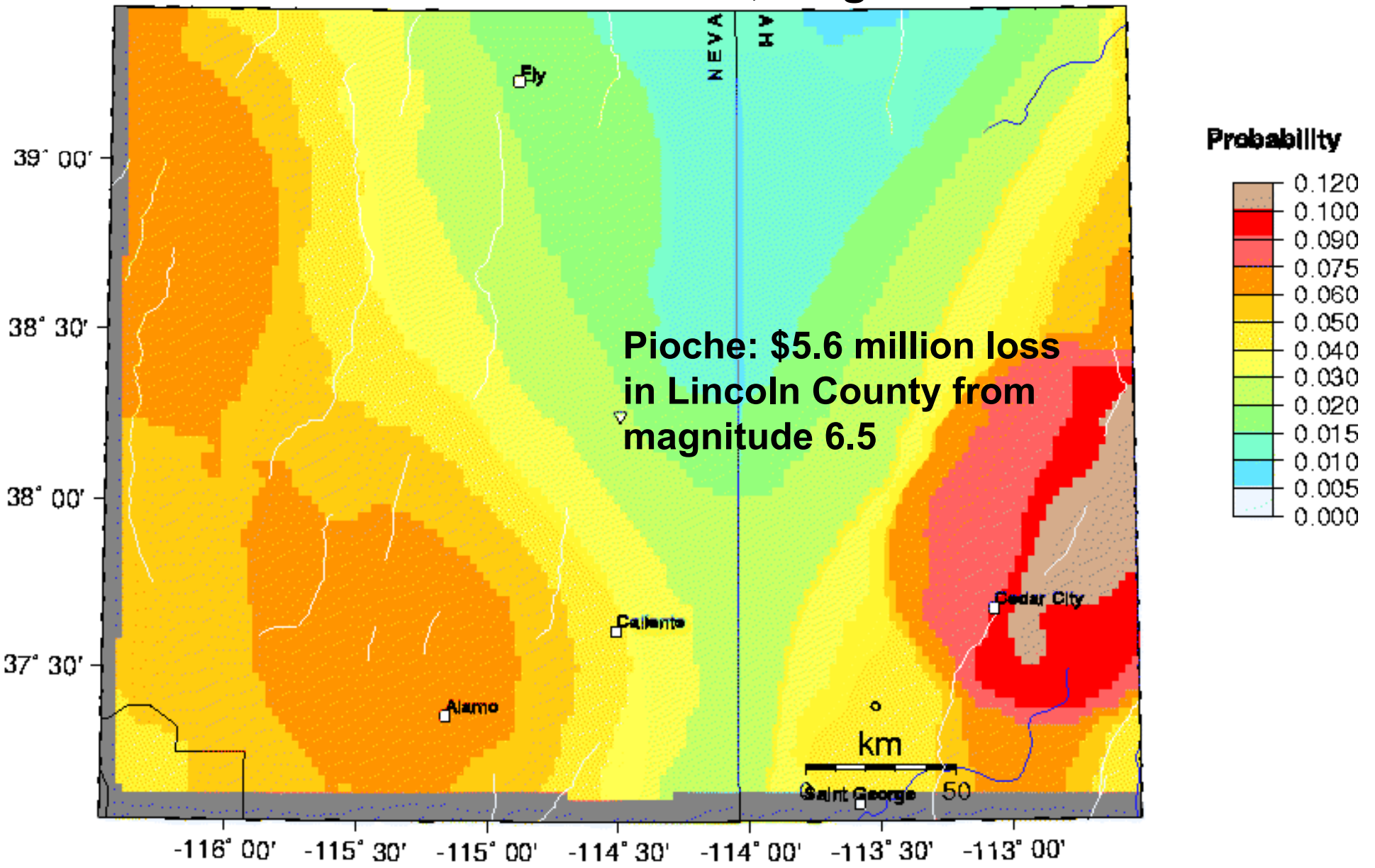


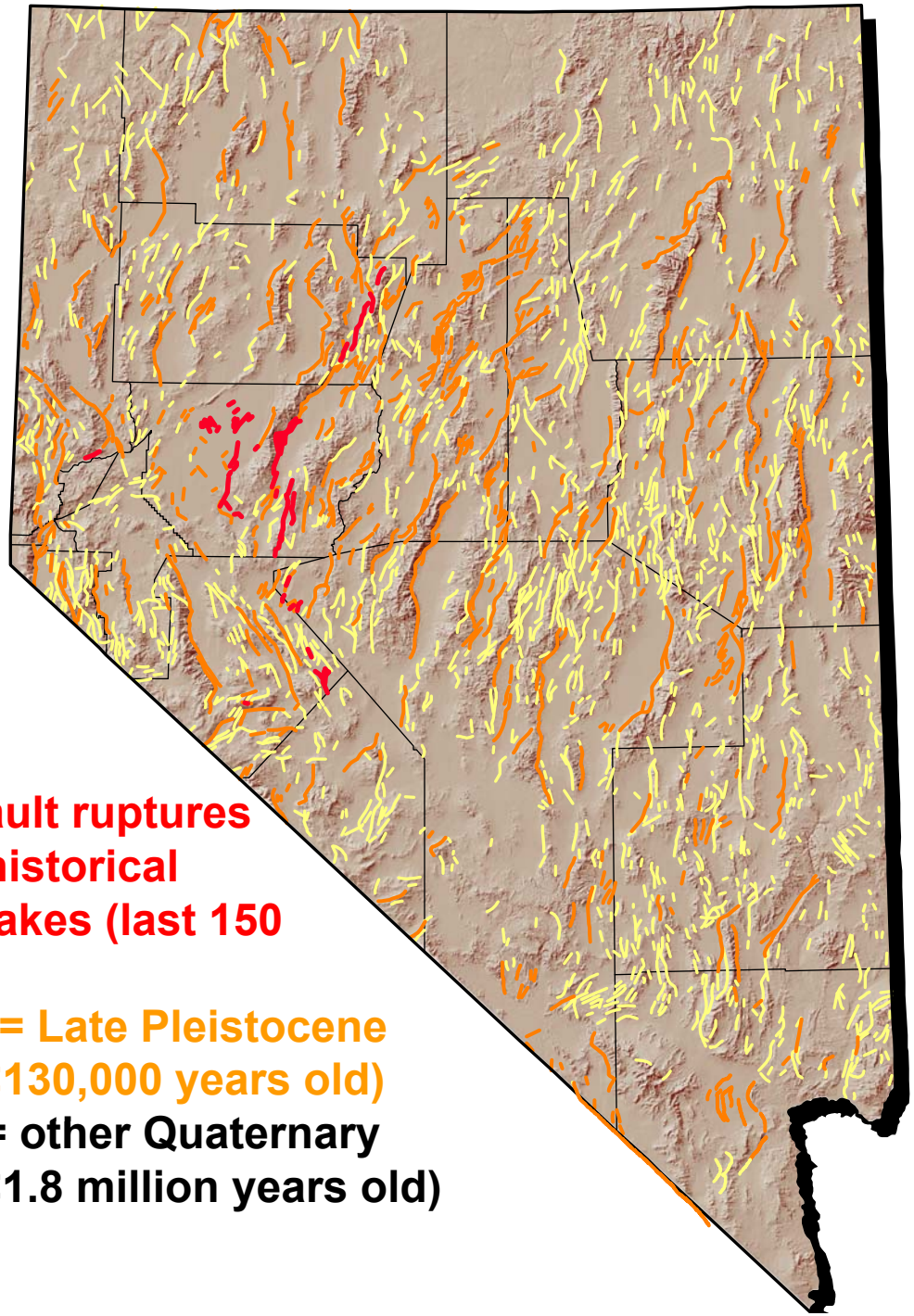


Active faults on the Caliente 1 x 2-degree sheet

Probability of an earthquake of magnitude 6.5 or greater occurring within 50 km in 50 years (from USGS probabilistic seismic hazard analysis)

2-3% chance for Pioche, magnitude 6.5





Red = fault ruptures during historical earthquakes (last 150 years)

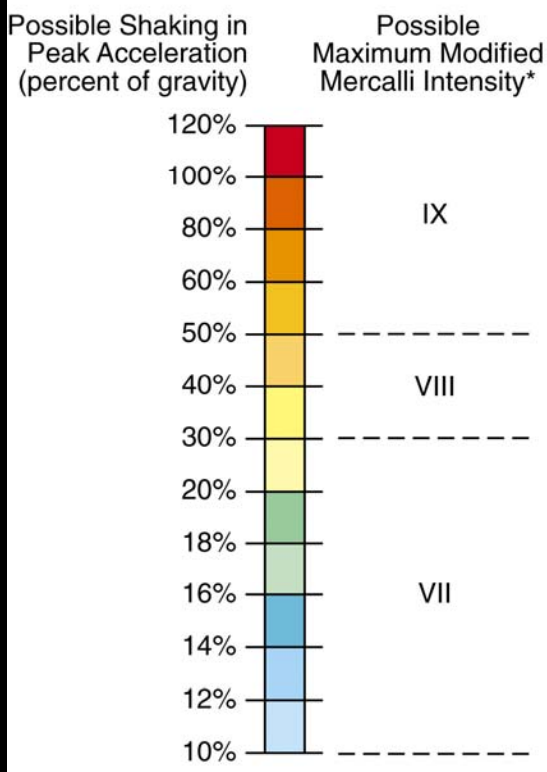
Orange = Late Pleistocene faults (<130,000 years old)

Yellow = other Quaternary faults (<1.8 million years old)

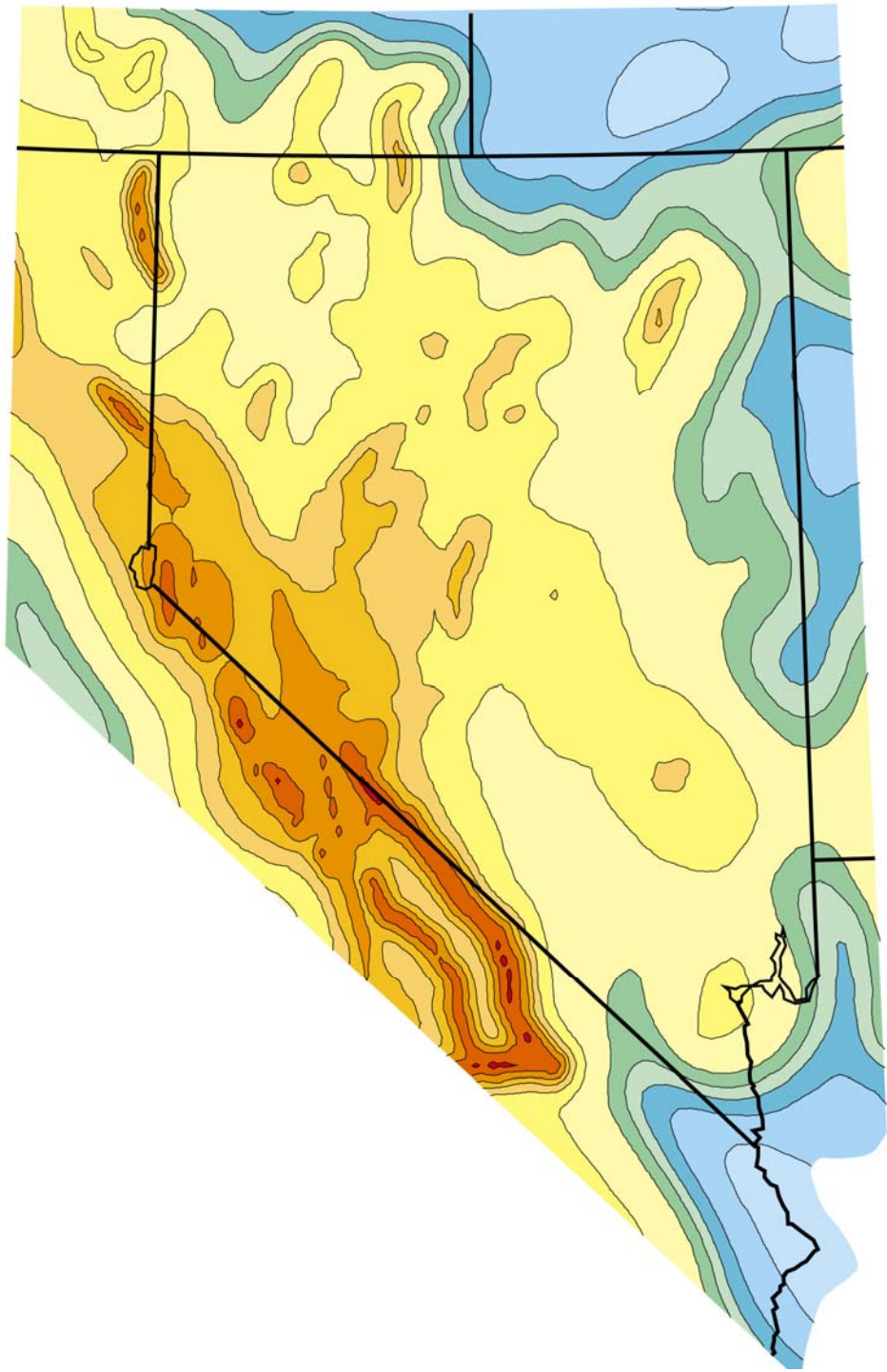
There are active faults nearly everywhere in Nevada,

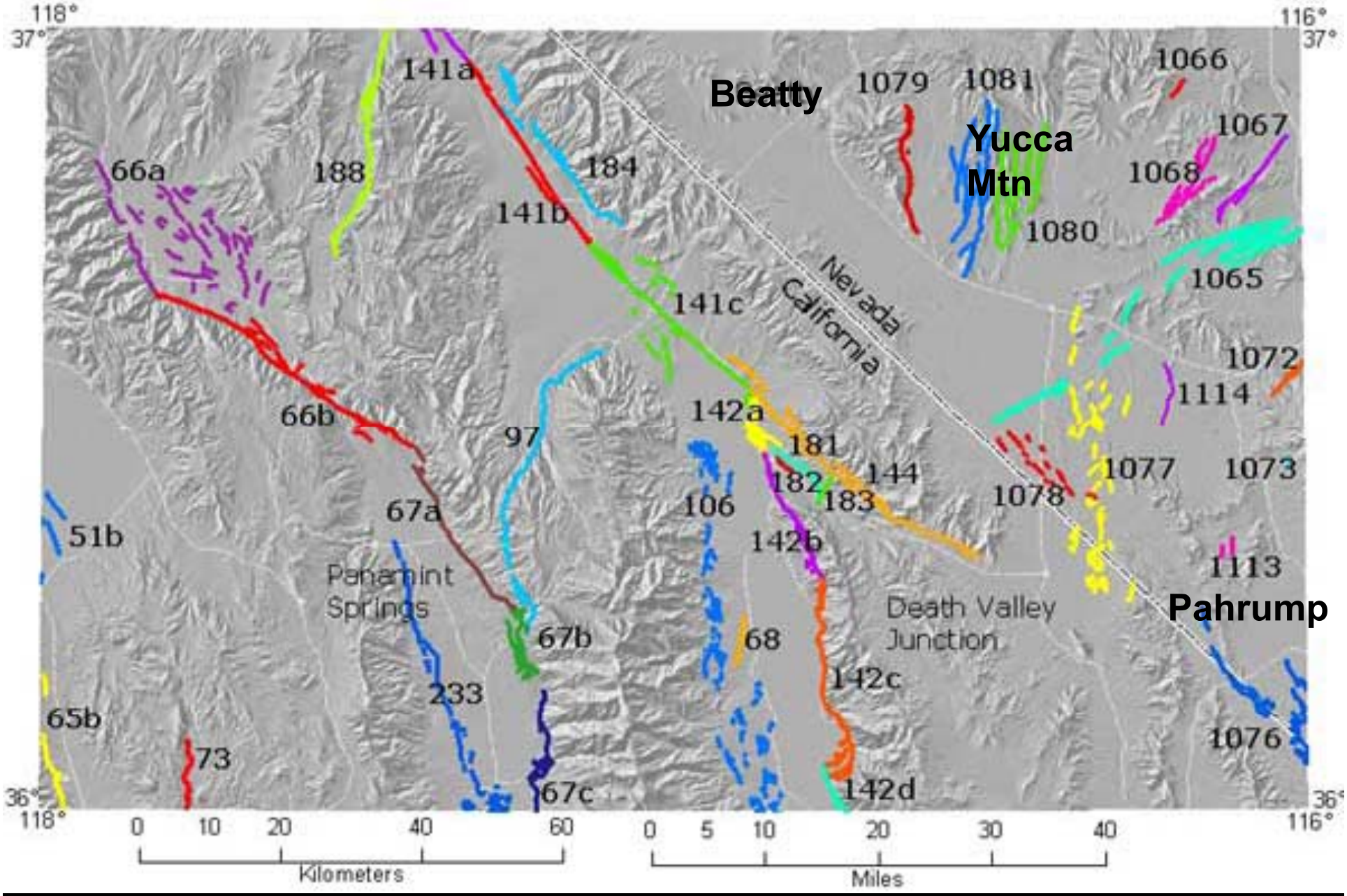
but not everywhere.

Shaking Potential Map for Nevada

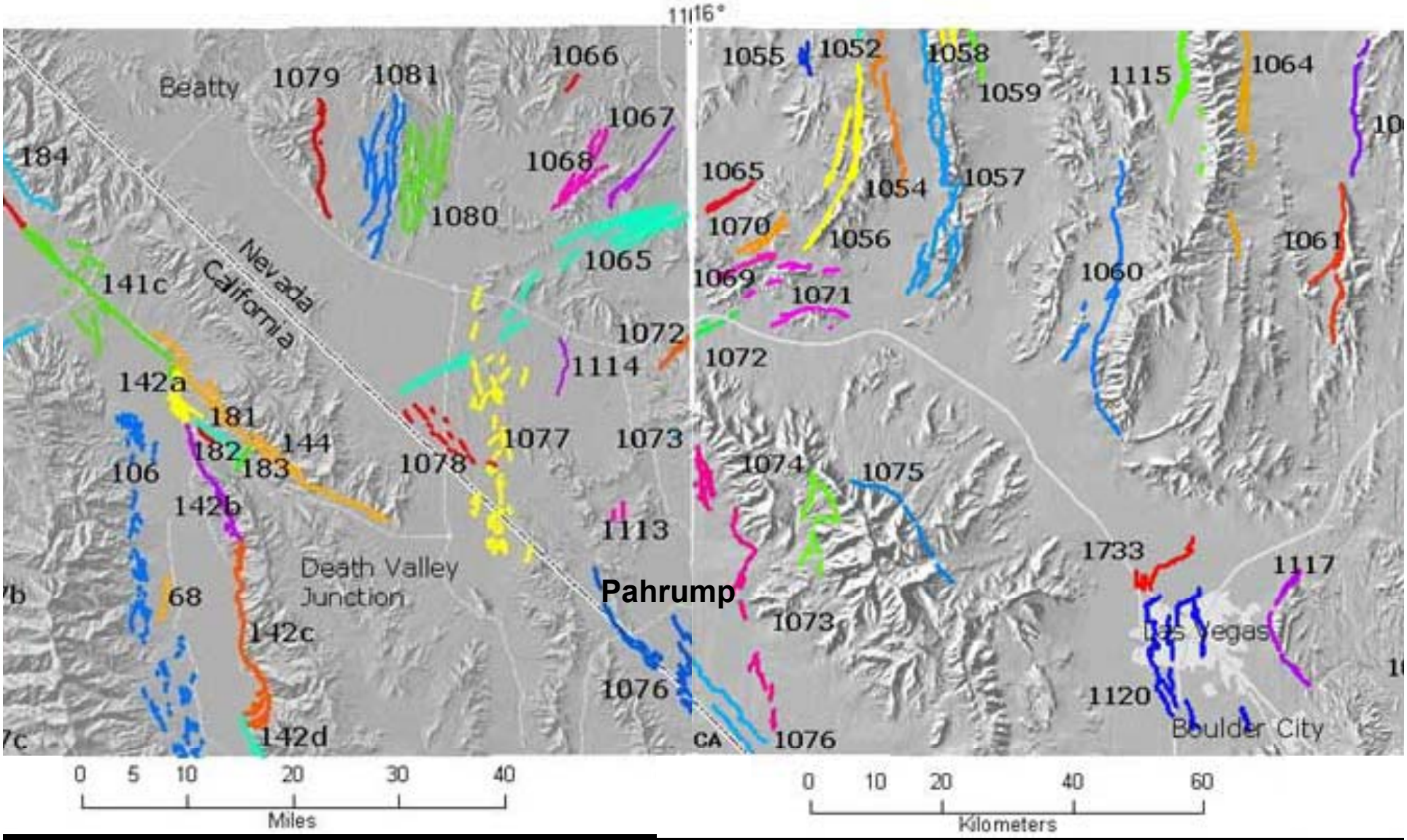


* See page 4 for descriptions of Intensity VII and VIII. In Intensity IX, general panic occurs and there may be damage to some well-built structures.





Faults on the Death Valley 1 x 2-degree sheet



1076 = Pahrump fault (Pahrump Valley fault zone); this is a right-lateral strike-slip fault, as are the San Andreas fault and the Death Valley fault system.

1073 = West Spring Mountains fault; this is a "normal" fault.

The risks are huge.

For a magnitude 7.0 earthquake on the Pahrump Valley fault zone, HAZUS estimated:

$200 million to $800 million in economic loss
($200 million for Nye County alone)

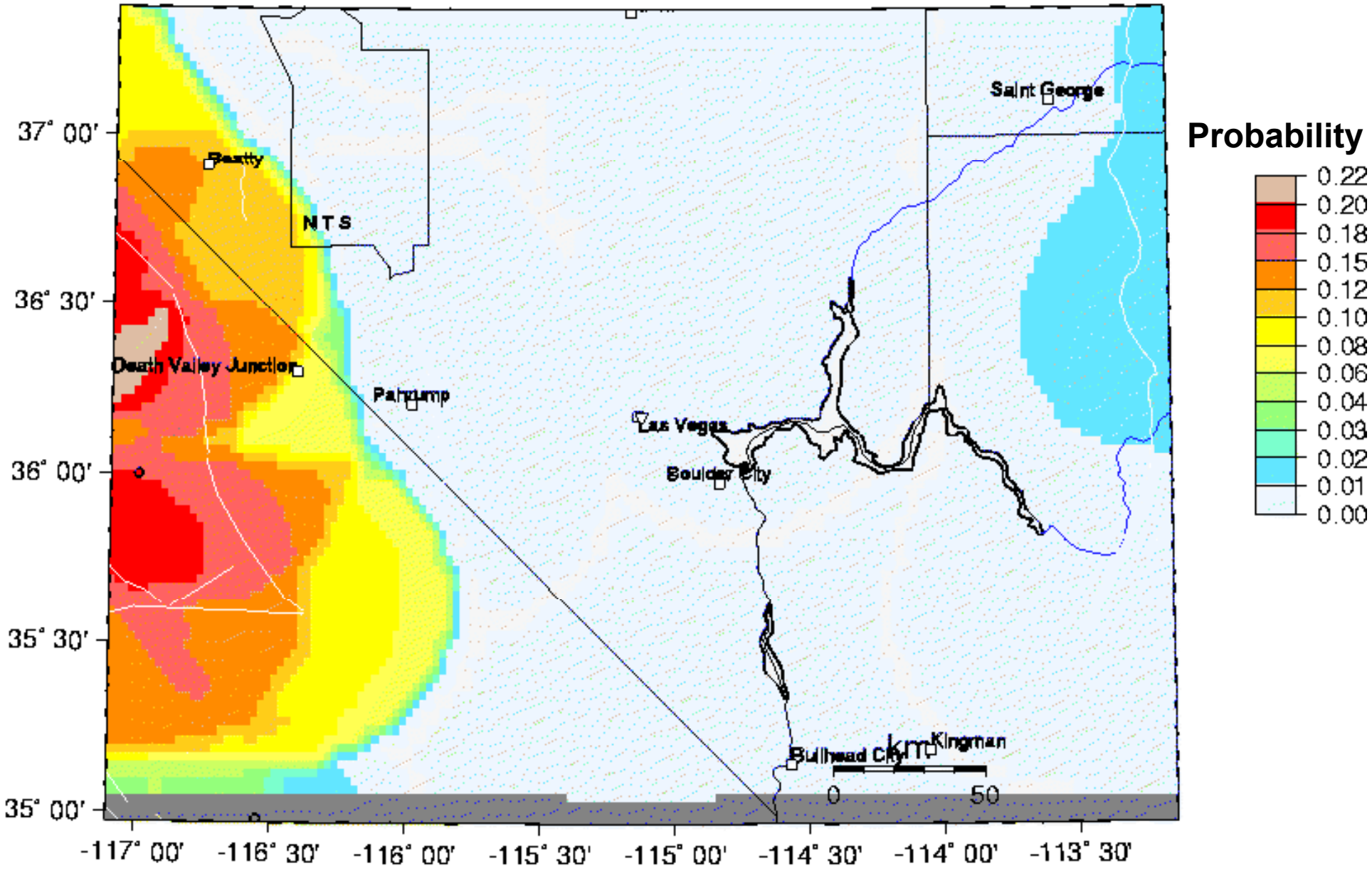
major damage to approximately 6,000 buildings

40 to 140 people needing public shelter

<20 fatalities.

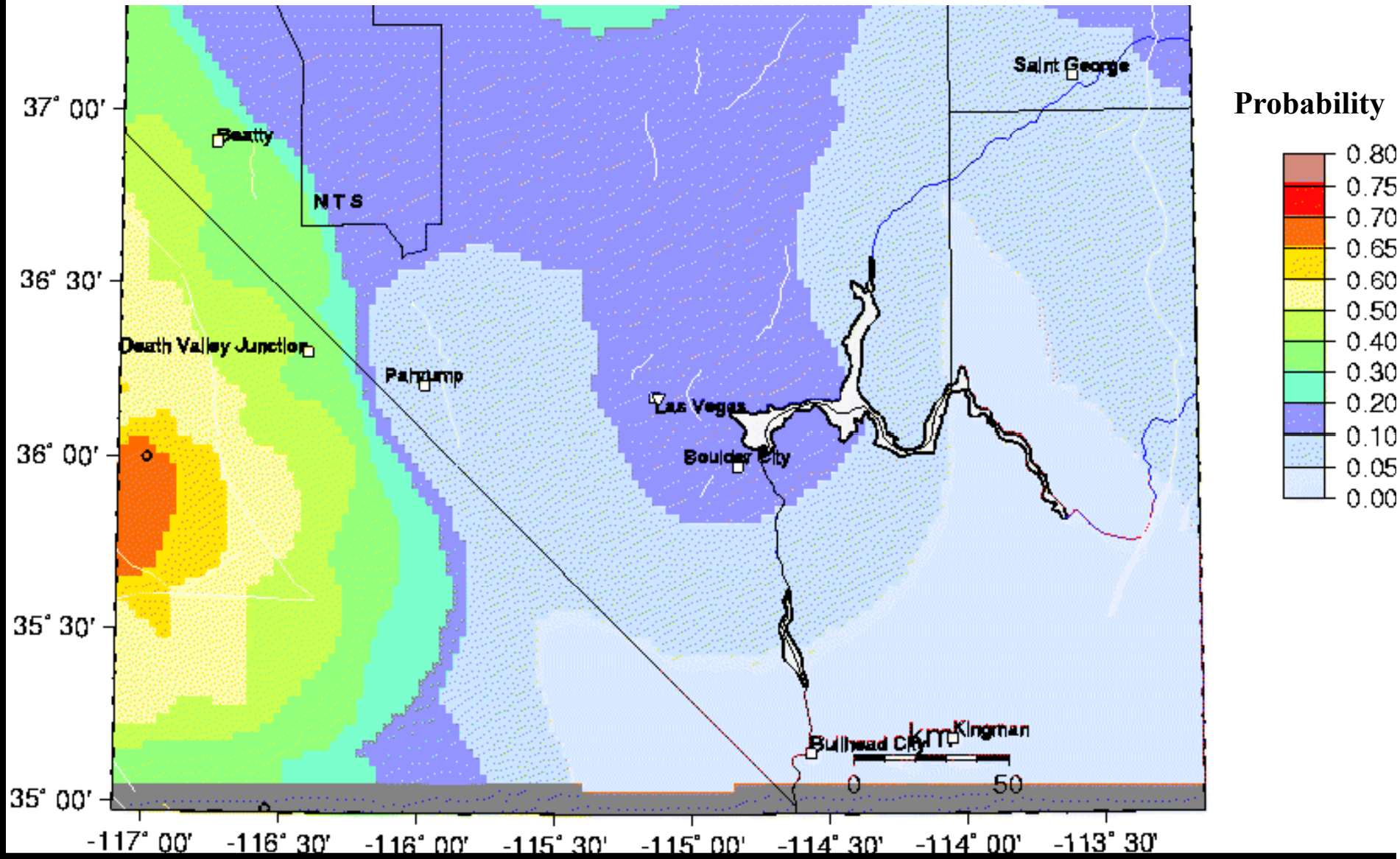
*** Figures could be higher; populations in Nye and Clark Counties has increased by about 30% since the 2000 census.**

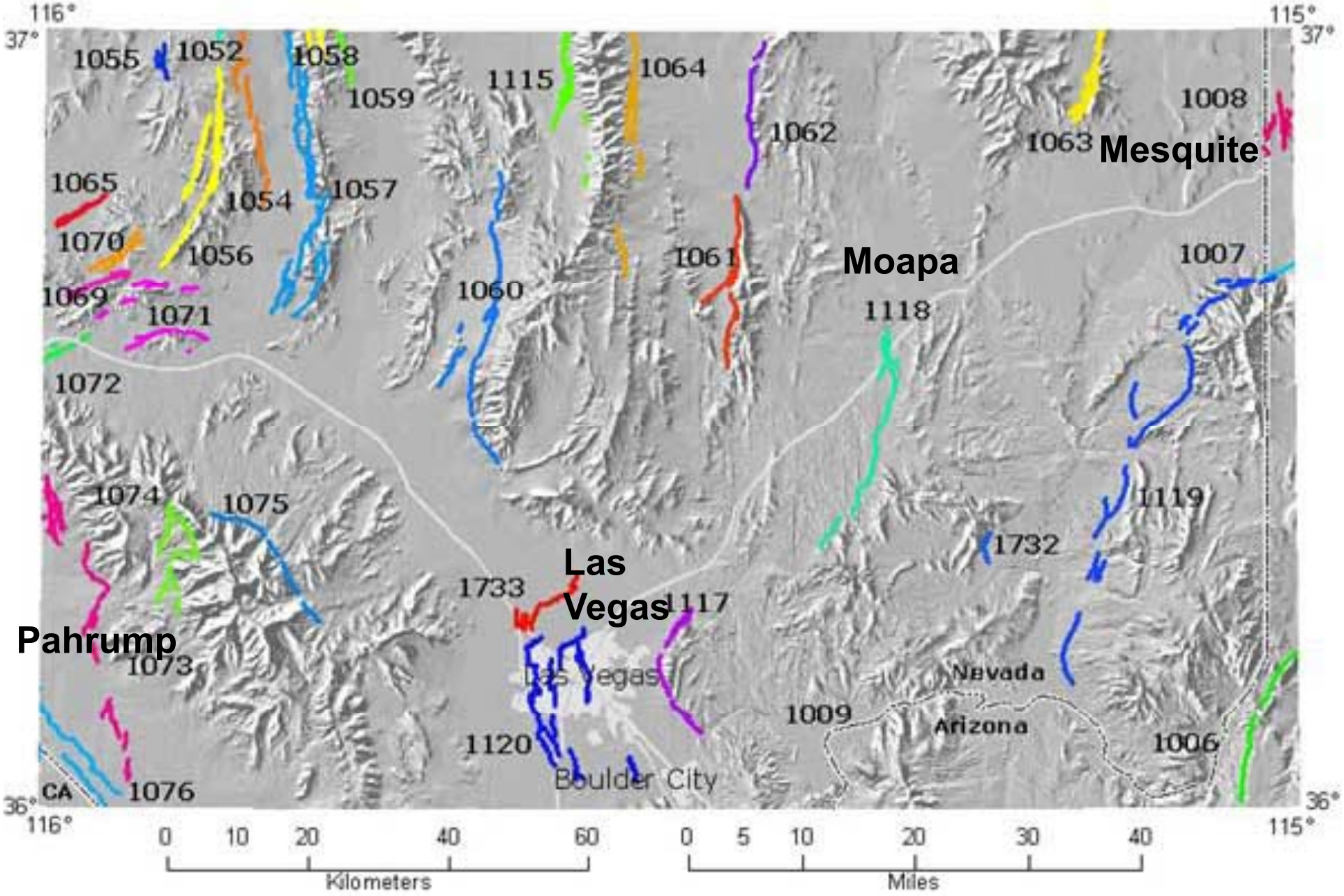
Probability of an earthquake of magnitude 7.0 or greater occurring within 50 km in 50 years (from USGS probabilistic seismic hazard analysis)
<1% chance for Las Vegas or Pahrump, magnitude 7



Probability of an earthquake of magnitude 6.0 or greater occurring within 50 km in 50 years (from USGS probabilistic seismic hazard analysis)

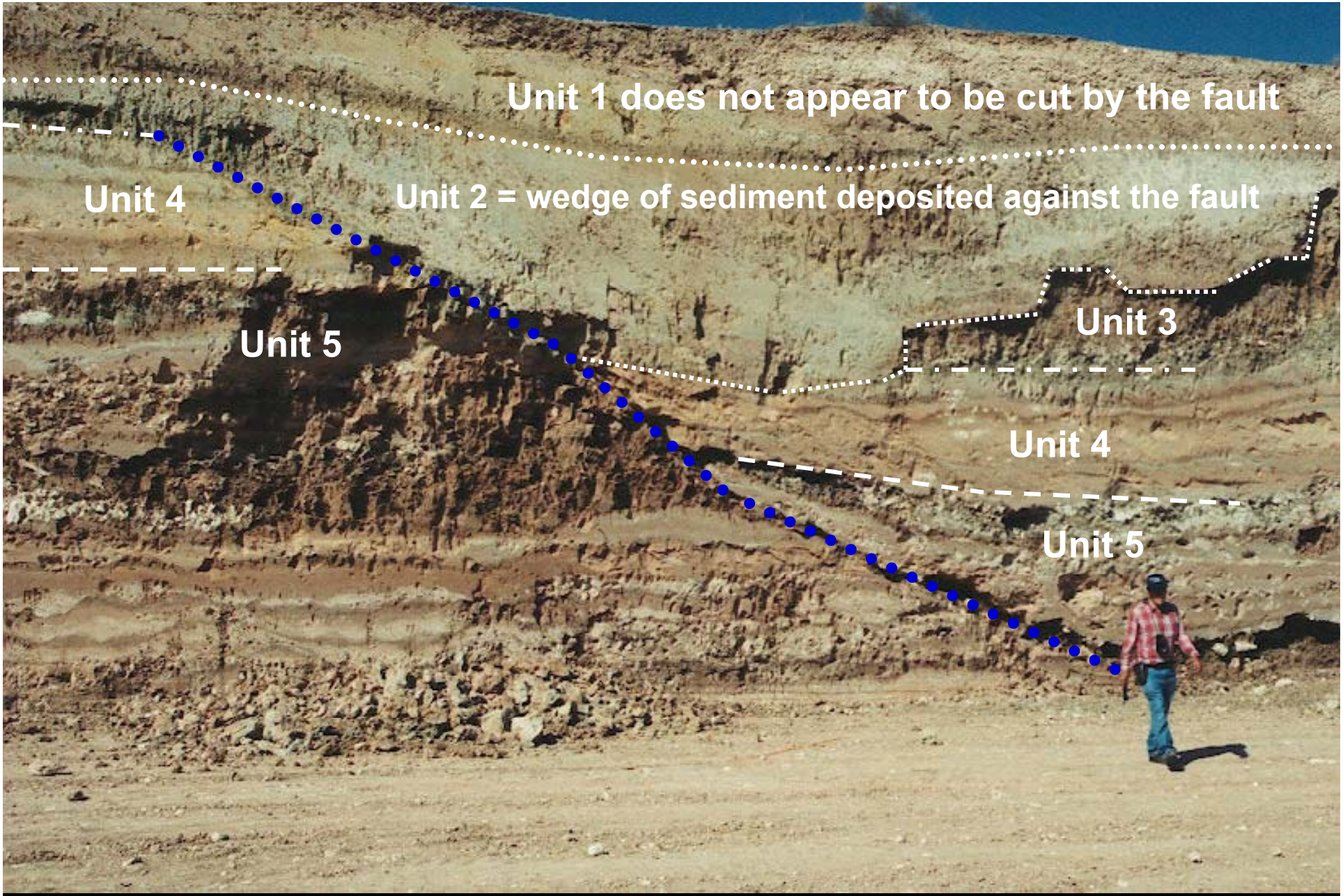
5-10% chance for Pahrump, magnitude 6



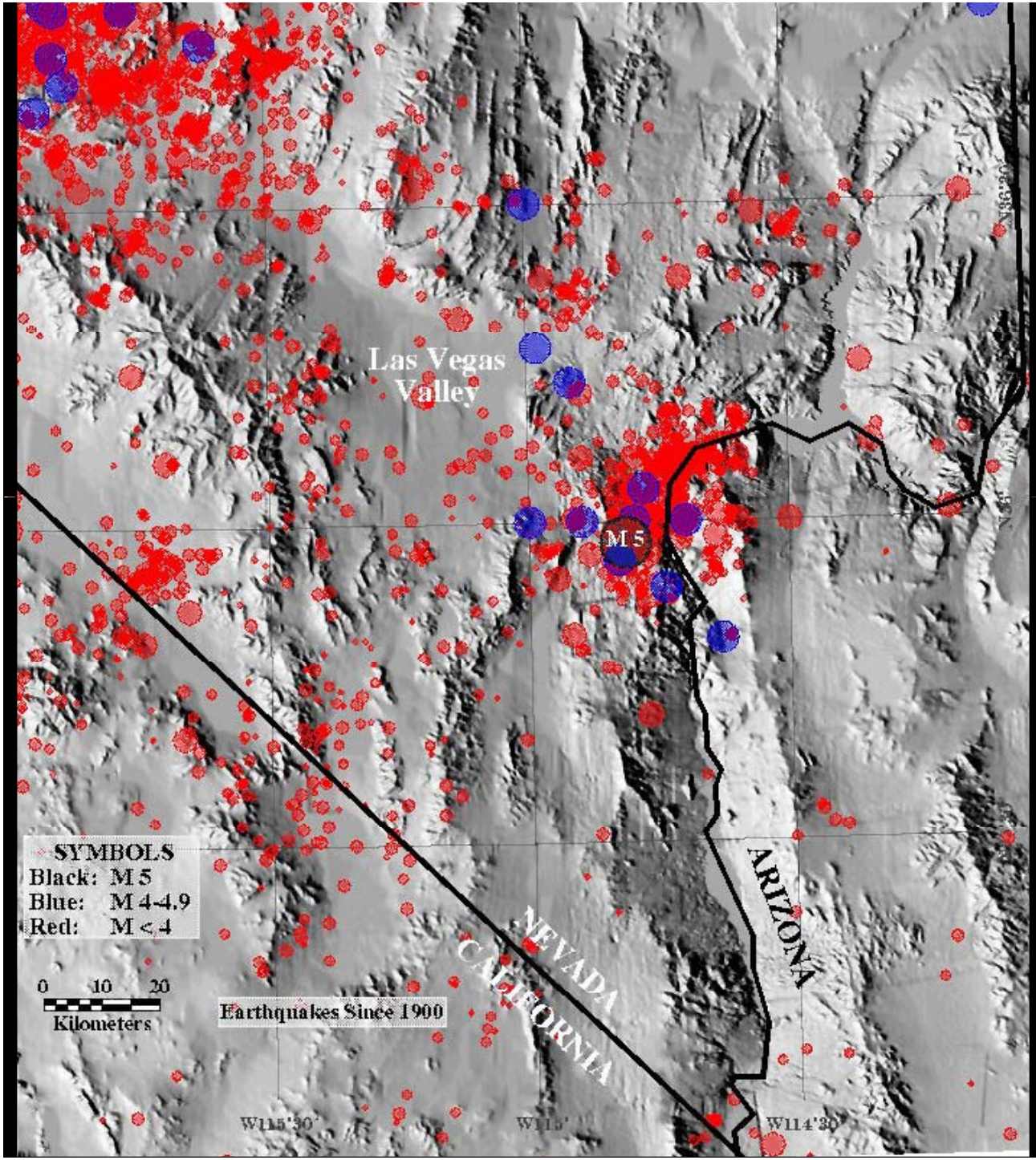


Faults on the Las Vegas 1 x 2-degree sheet

Quaternary fault exposed at construction site in Las Vegas Valley



Quaternary fault exposed at construction site in Las Vegas Valley



Measured earthquakes in the Las Vegas area

The risks are huge.

For a magnitude 6.6 earthquake on the Frenchman Mountain fault, HAZUS estimated:

$4.4 to 17.7 billion in economic loss

major damage to approximately 30,000 buildings

10,000 to 40,000 displaced households

3,000 to 11,000 people needing public shelter

The risks are huge.

For a magnitude 6.6 earthquake on the Frenchman Mountain fault, HAZUS estimated:

3,000 to 11,000 people needing medical aid

700 to 3,000 people needing hospitcal care

100 to 400 people with life-threatening injuries

200 to 800 fatalities.

For a magnitude 5.9 daytime earthquake on the Frenchman Mountain fault, HAZUS estimated, for all of Clark County:

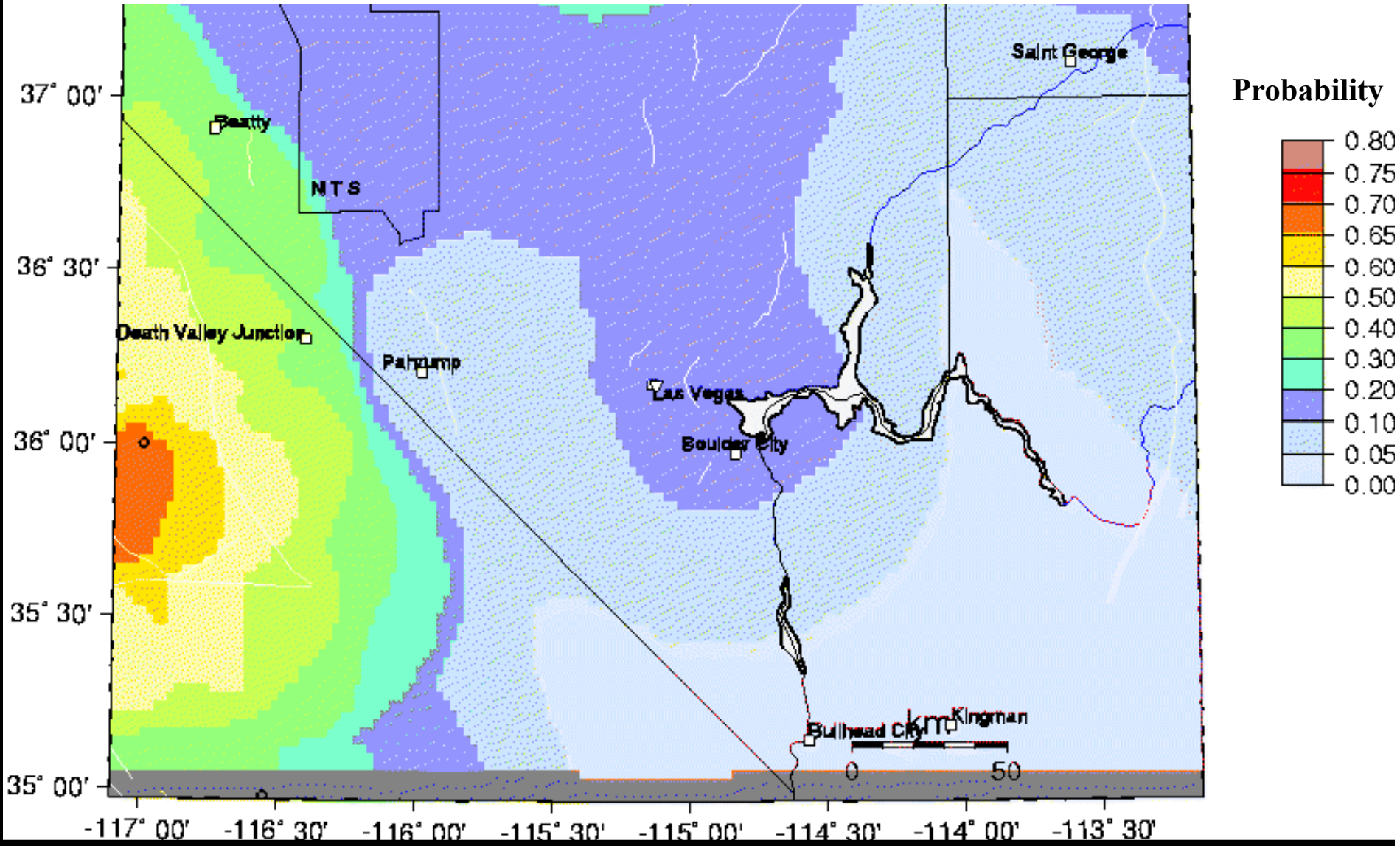
$2.2 to 8.9 billion in economic loss,
of which $1.2 to 4.7 billion would be in building damage,
$0.3 to 1.3 billion would be in damage to building contents, and
$0.7 to 2.9 billion in business interruption losses related to the building stock;

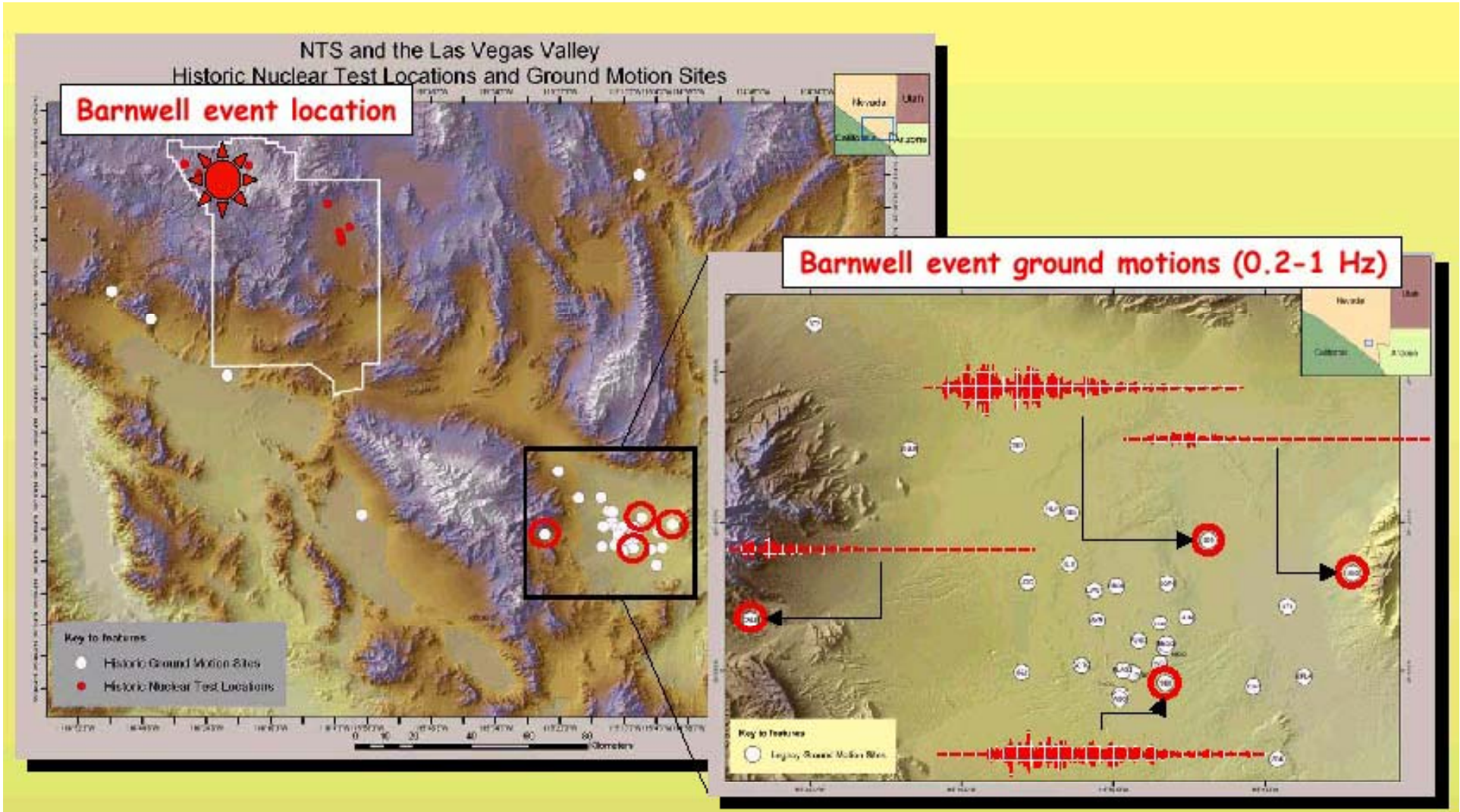
major damage to 4,000 to 17,000 buildings
(655 completely destroyed),
3,000 to 12,000 people needing public shelter,
300 to 1,200 people needing hospital care (*but only 768 of 2,341 beds would be available in the county during the first day, up to 910 at Day 3 and 1,730 at Day 30*); **and**
80 to 300 fatalities.
(Casualty numbers are expected to be less for either a night-time or commute-time earthquake.)

(from NBMG-NDEM-FEMA-sponsored earthquake exercise for the City of Las Vegas, 2003)

Probability of an earthquake of magnitude 6.0 or greater occurring within 50 km in 50 years (from USGS probabilistic seismic hazard analysis)

10-20% chance for Las Vegas area, magnitude 6





Data from NTS shots showed that sites in Las Vegas Valley shake more than sites on bedrock (because of loose soils and/or amplification of seismic waves due to the geometry of the basin).

The main points:

1. The earthquake risks are huge in Nevada.

2. We can do something about it.

   a. Be prepared to respond.

   b. Mitigate structural risks, largely through building codes and avoiding faults and areas of liquefaction.

   c. Mitigate nonstructural risks.

Nonstructural damage often can be easily prevented.

Earthquake-secure bookshelves in the office of the State Geologist

Secured computers at the Clark County Building Department


PHILIPS
Desktop Editor

Information about Nevada earthquakes and what you can do:

Nevada Bureau of Mines and Geology
www.nbmg.unr.edu

Nevada Seismological Laboratory
www.seismo.unr.edu

University of Nevada, Las Vegas
earthquakes.unlv.edu

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