

Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault–Salt Lake City Segment

Hazards and Loss Estimates



Developed by the
Earthquake Engineering Research Institute,
Utah Chapter

Prepared for the
Utah Seismic Safety Commission



June 4, 2015

Utah League of Cities and Towns
By
Brent Maxfield
President - EERI Utah Chapter
September 16, 2015

Earthquake Engineering Research Institute (EERI) Utah Chapter <http://utah.eeri.org>

Wednesday, September 16, 2015 NEWS FEED



Utah Chapter
Earthquake Engineering Research Institute

Search the website

HOME**WASATCH FAULT SCENARIO REPORT**SHORT COURSESOFFICERSNEWSLETTERJOIN

CHAPTER MEETINGSNEWS AND ANNOUNCEMENTSPAST EVENTS

CHAPTER MEETINGS



SEAU/EERI Meeting – Nepal Earthquake Reconnaissance
October 15, 2015, 5:30 p.m. Joint EERI Utah Chapter/SEAU Meeting Nepal Earthquake...

Past Chapter Meetings

UPCOMING EVENTS

More Upcoming Events

NEWS AND ANNOUNCEMENTS

Wasatch Fault Scenario Report
The report Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault—Salt Lake...

Video – Wasatch Fault Fly By
Fly along the Wasatch fault in Google earth to explore the earthquake risks along...

Video – Utah: Preparedness Now
What can happen if a 7.0 magnitude earthquake strikes the Wasatch Fault? This video,...

JOIN EERI TODAY

Visit www.EERI.org to learn how.

Interested in trying the Utah Chapter first? Register as a Utah Chapter Member only.

CALENDAR OF EVENTS

Oct 15, 2015
Combined SEAU/EERI Meeting Nepal Earthquake Reconnaissance

TWITTER



Message of the Scenario Report

- ▶ **PREPARE!**

- ▶ State

- ▶ County

- ▶ City or Town

- ▶ Community

- ▶ Family

- ▶ **YOU!**

Prepare!

- ▶ Prepare to WITHSTAND
- ▶ Prepare to RESPOND
- ▶ Prepare to RECOVER

Audience for Report

- ▶ Utah Seismic Safety Commission
- ▶ YOU!



Photo Credit: Rod Millar

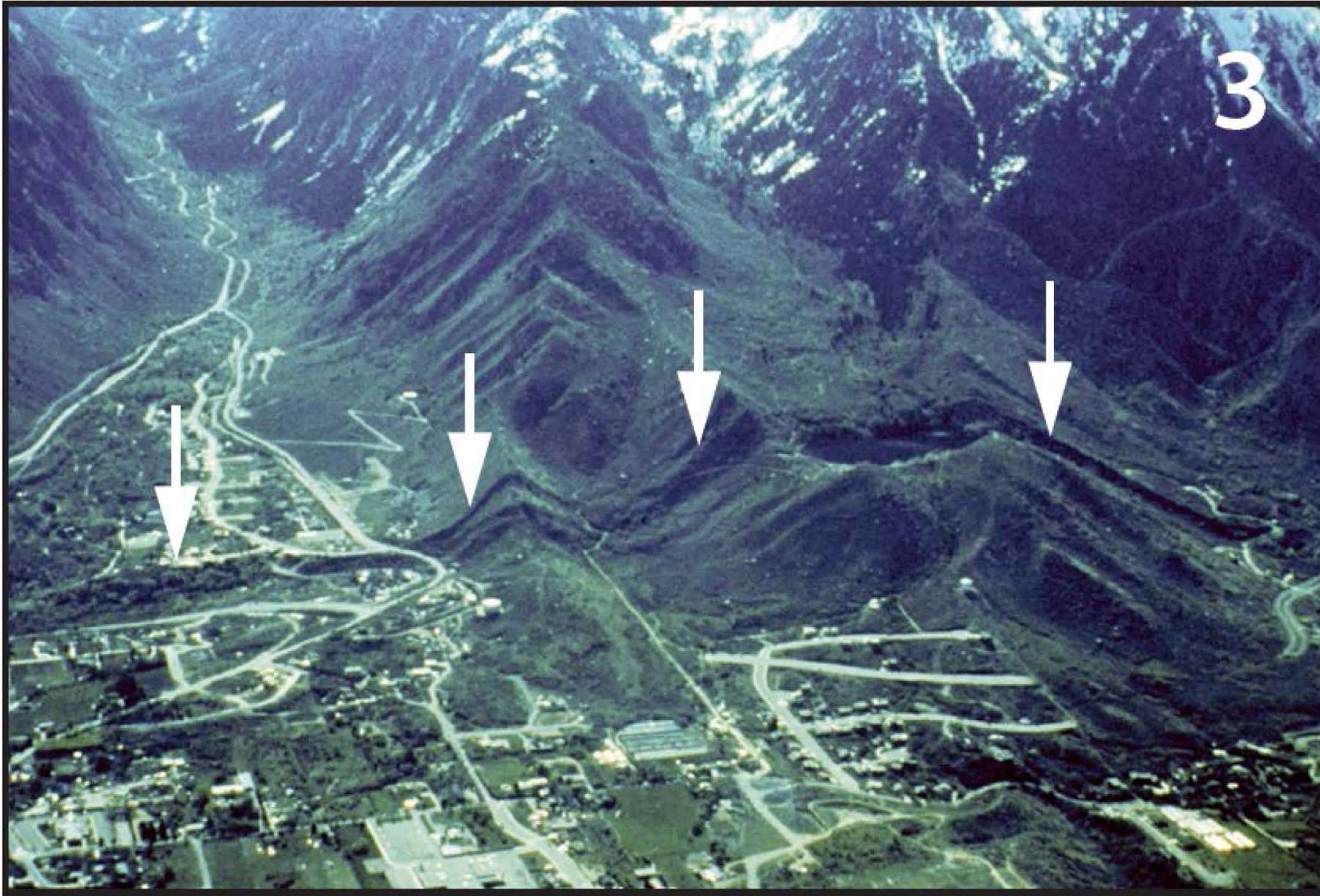
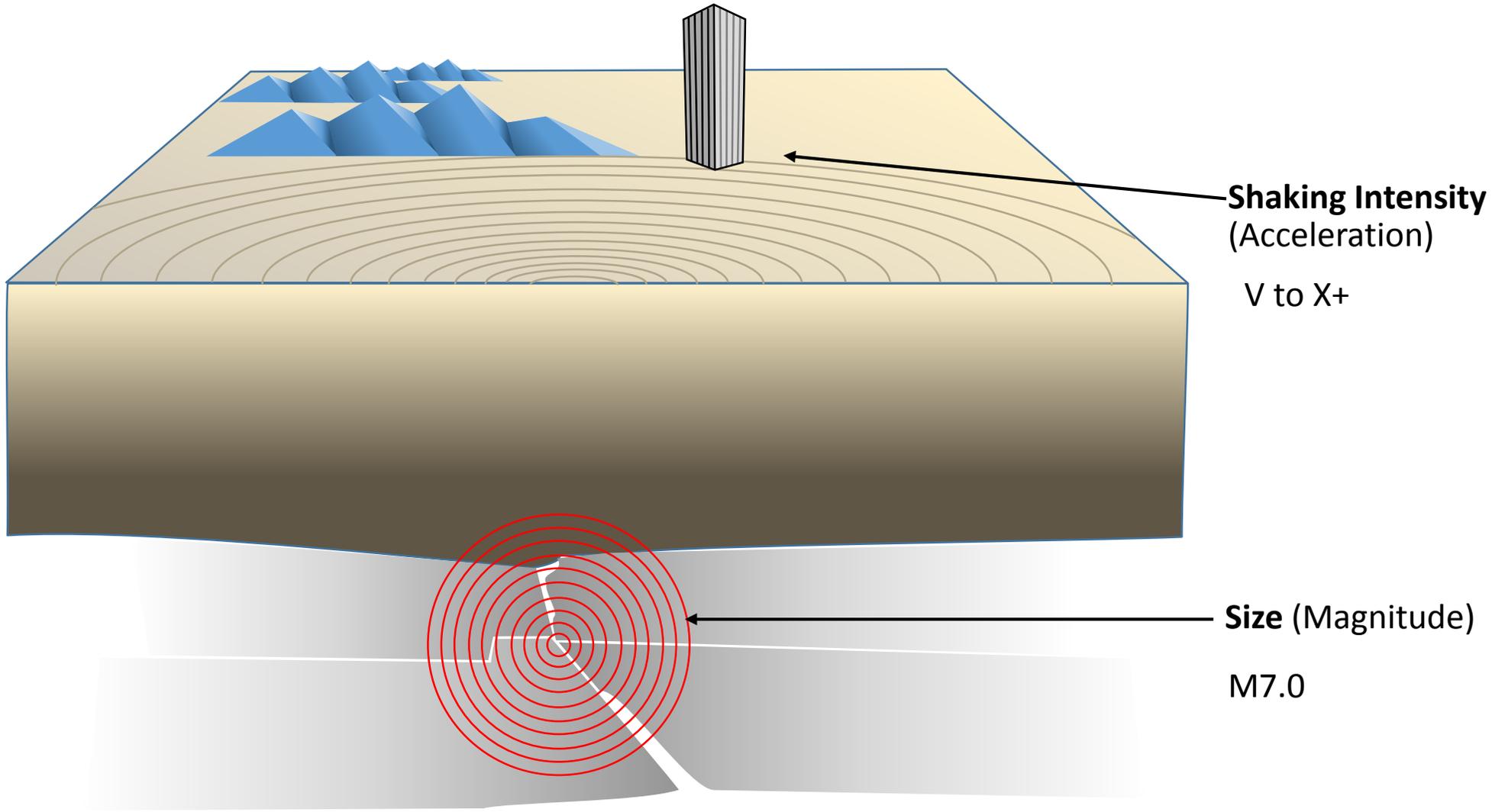


Photo Credit: Utah Geological Survey

Magnitude 7.0 vs Shaking Intensity





What is the Scenario?

- ▶ Possible outcome
- ▶ Based on expected average

What the Scenario is NOT?

- ▶ Prediction
- ▶ Not the worst case

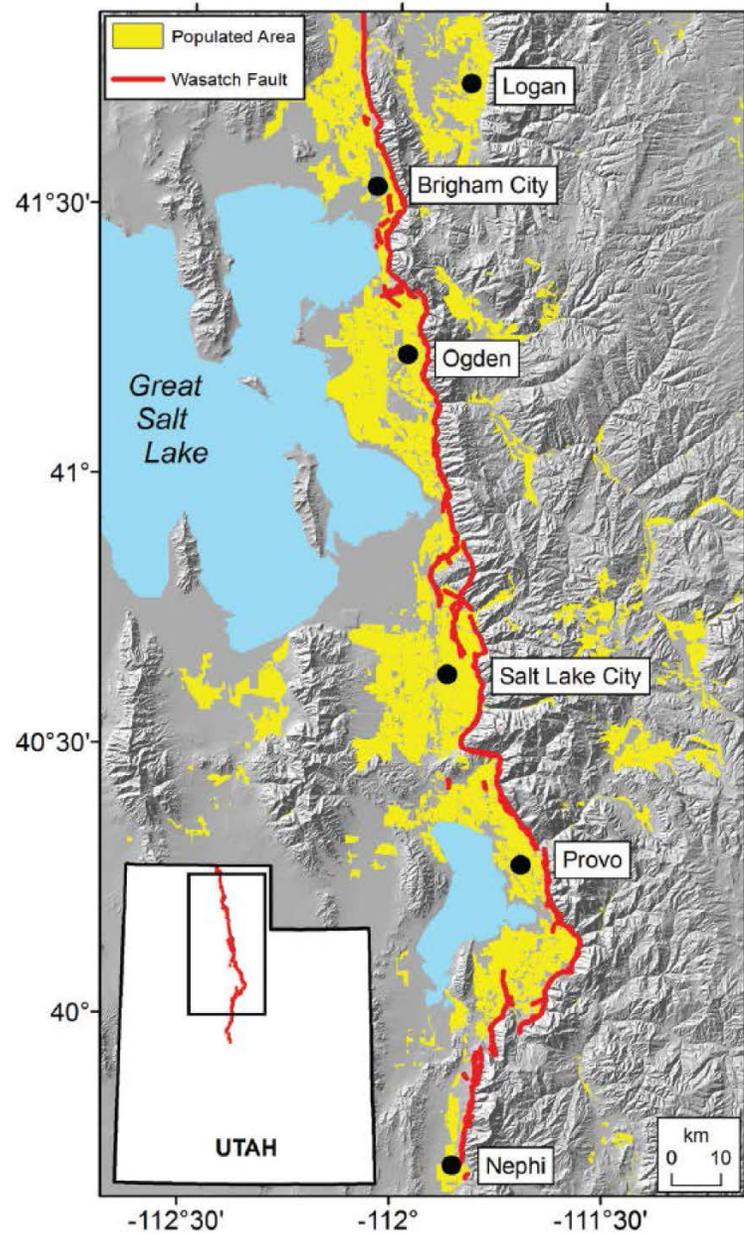
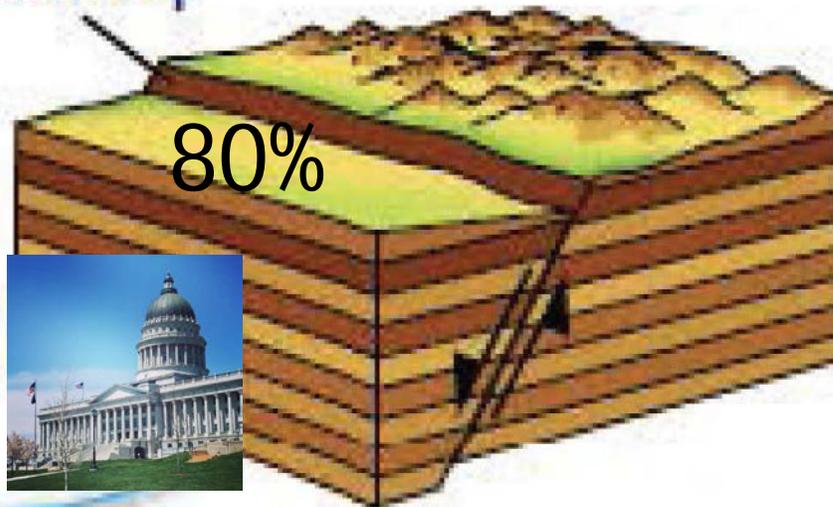


Figure 1. Map of Utah's Wasatch Front urban corridor showing populated areas (in yellow) along the Wasatch fault (in red). Population data from 2010 (figure courtesy of the University of Utah Seismograph Stations).

75%

Fault Scarp

80%



Large Prehistoric Earthquakes on the Wasatch Fault

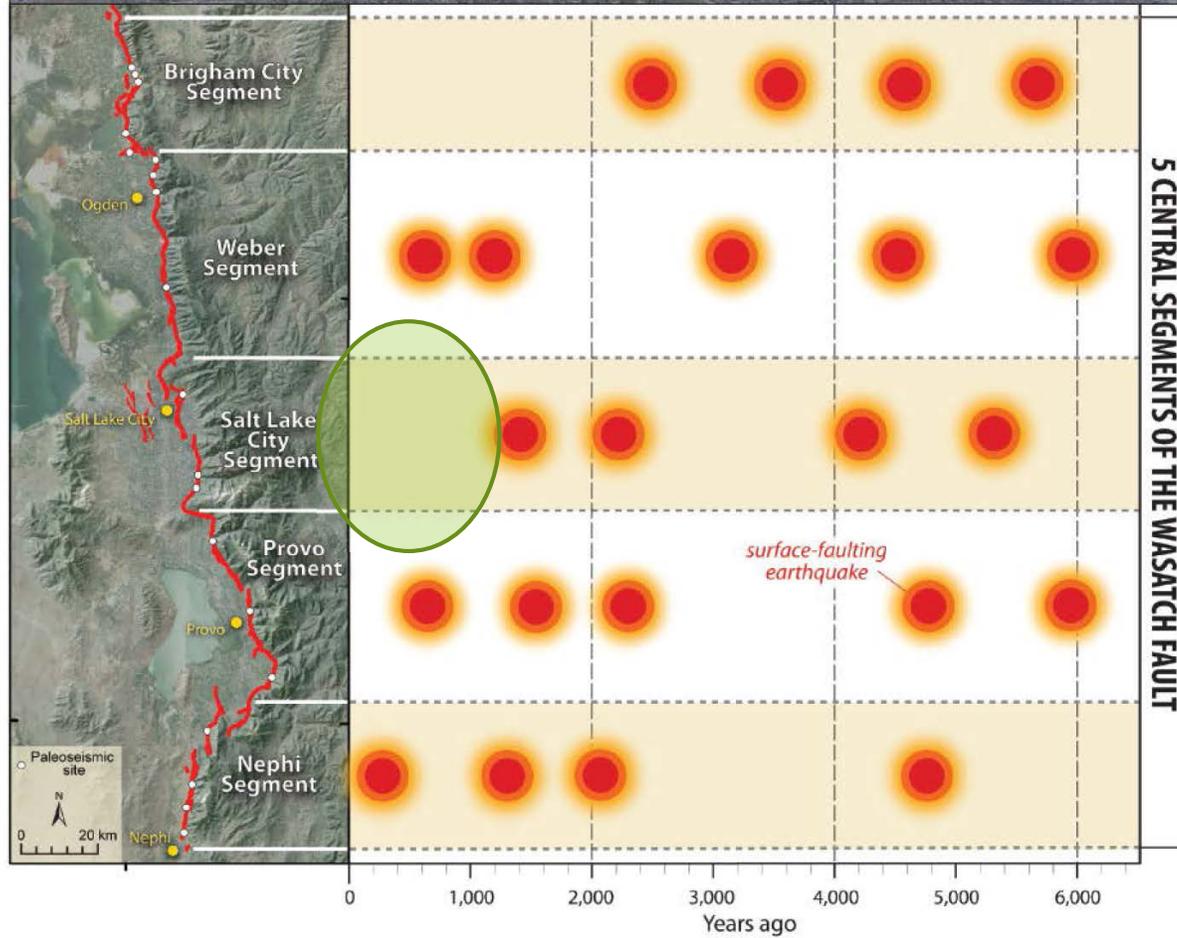


Figure 4. Schematic plot showing the timing of large prehistoric earthquakes on the Wasatch fault (elements of the figure provided by the Utah Geological Survey).

Prepared to WITHSTAND

- ▶ Strengthen Weak Buildings
 - Unreinforced Masonry (URM)
 - Non-ductile Concrete (NDC)
- ▶ Retrofit government URM and NDC buildings!
- ▶ Private Sector
 - ▶ Mandatory retrofit?
 - ▶ Incentive funds?
 - ▶ Public outreach and information
 - ▶ Make building owner economics work
 - ▶ Safe = ↑ Rent
 - ▶ Unsafe = ↓ Rent



Collapse of URM building - 2011 Mw 6.1 Christchurch, New Zealand earthquake. Photo: EERI/Justin Marshall.

90,000

Majority of Deaths

Prepared to WITHSTAND

- ▶ The building code save lives
- ▶ It does not prevent economic damage and economic loss
- ▶ Encourage business owners to consider economic loss when constructing new buildings by building beyond the building code.
 - ▶ Loss goes beyond the cost to fix or rebuild
 - ▶ Lost business income
 - ▶ Income loss to employees who can't work
 - ▶ Loss to community due to lost sales tax
 - ▶ How long can a business be closed before they go out-of-business?



Prepared to RESPOND

- ▶ YOU!
- ▶ Your Family
- ▶ Your Community
- ▶ Your City or Town
- ▶ Your County
- ▶ State

Prepared to RESPOND

- ▶ 2,400
- ▶ Inspectors

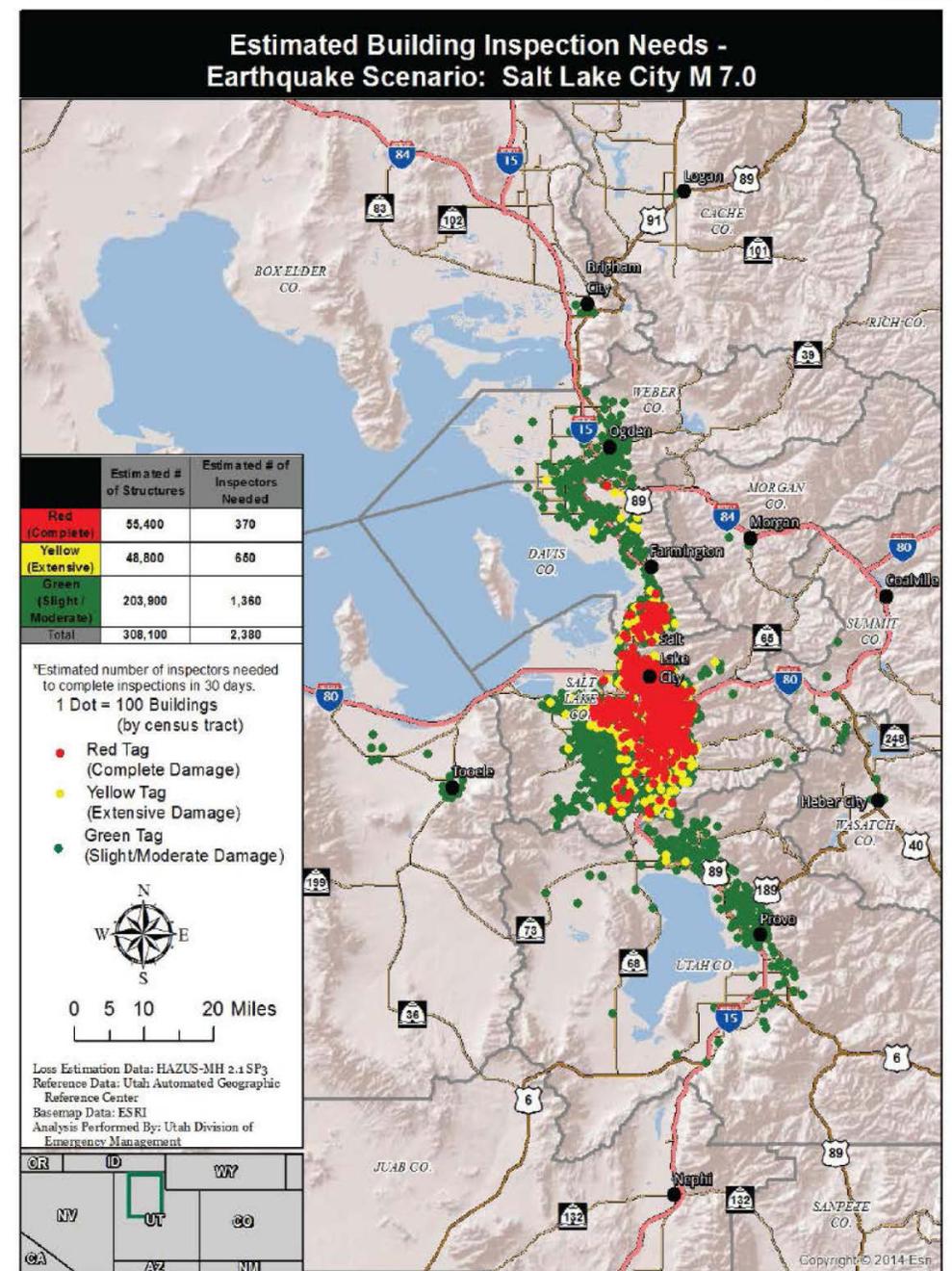


Figure 27. This map highlights where Hazus estimates the building damage will occur. Each dot represents 100 buildings per census tract. When the damaged building count falls below this level, there will be no indication of any damage on the map. However, there may be many areas that need safety inspections that do not appear on the map.

Prepared to RESPOND

- ▶ Encourage the adoption of BORP
- ▶ Building Occupancy Resumption Program
- ▶ (Salt Lake City & Murray City have adopted it)

- ▶ Allows business to preauthorize post earthquake inspection

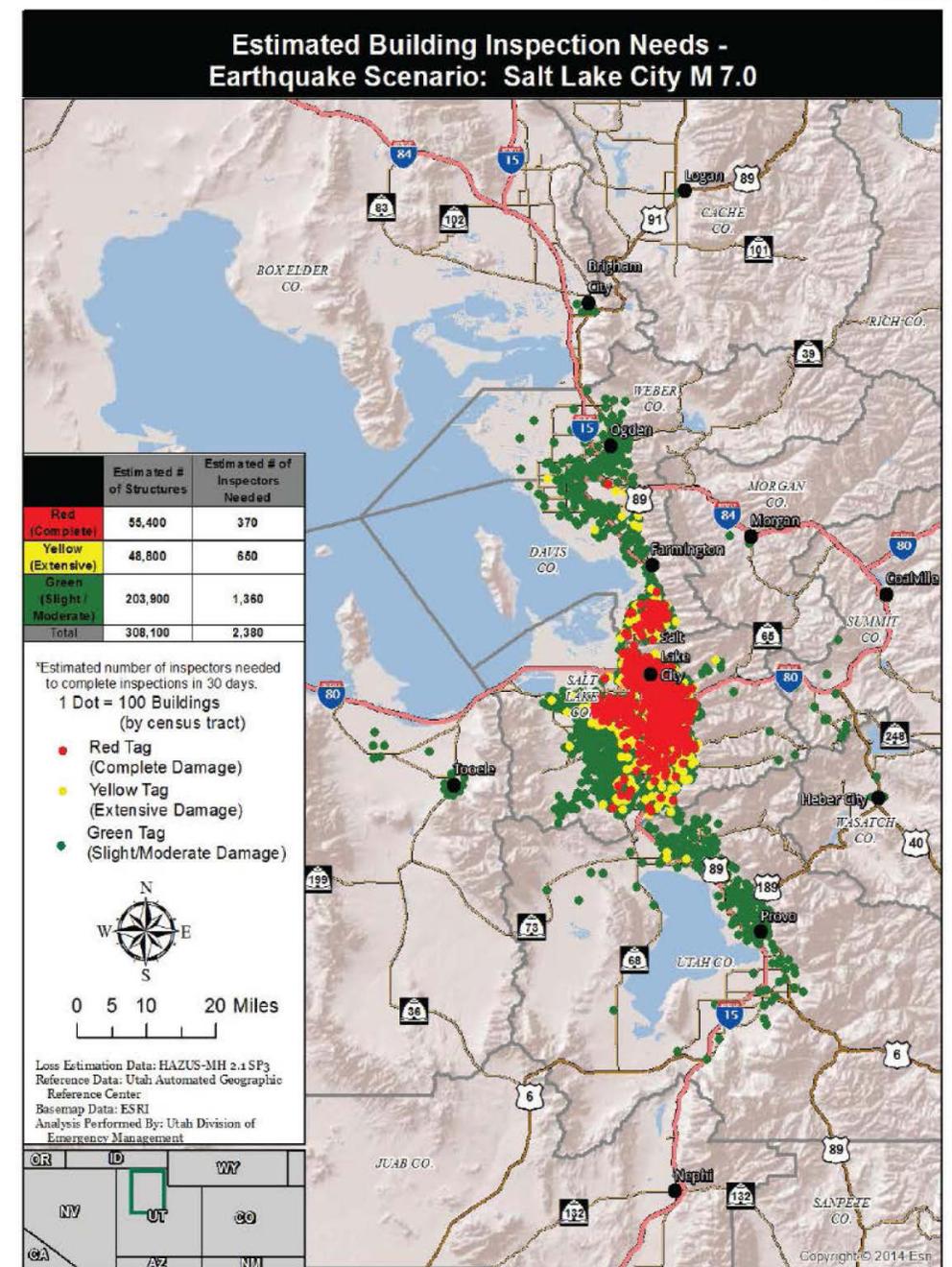


Figure 27. This map highlights where Hazus estimates the building damage will occur. Each dot represents 100 buildings per census tract. When the damaged building count falls below this level, there will be no indication of any damage on the map. However, there may be many areas that need safety inspections that do not appear on the map.

Prepared to RESPOND

- ▶ 53,000
- ▶ Public Shelter Needs

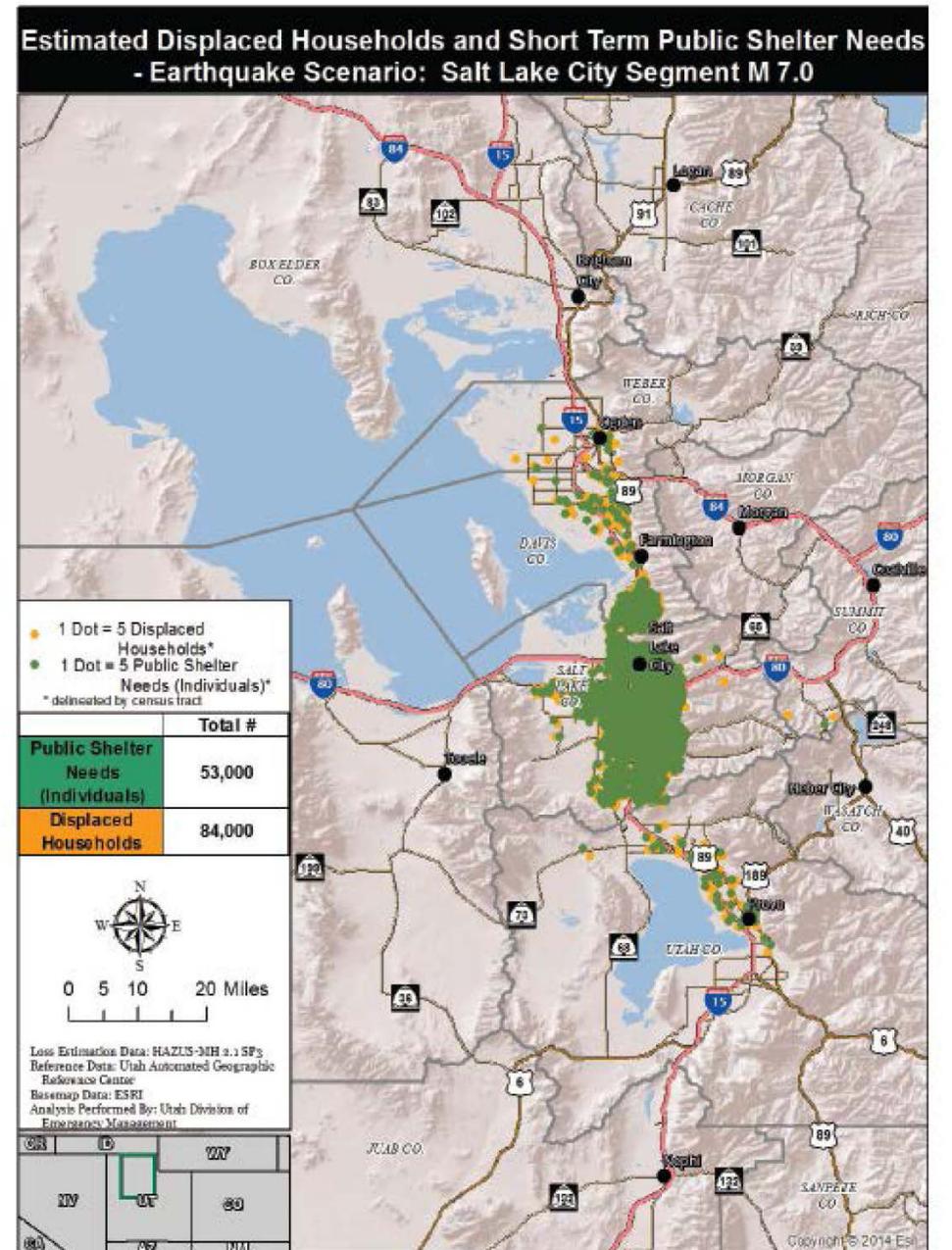


Figure 28. This map highlights where Hazus estimates displaced households and individuals seeking shelters will occur. The orange dots represent the number of displaced households and the green dots represent individuals seeking shelter (five each, respectively) per census tract. But if the count falls below this level, the map will indicate no displacement or shelter needs, even though there may be many areas of displaced households or individuals seeking shelters.

Prepared to RESPOND

- ▶ High probability of moderate HOSPITAL damage

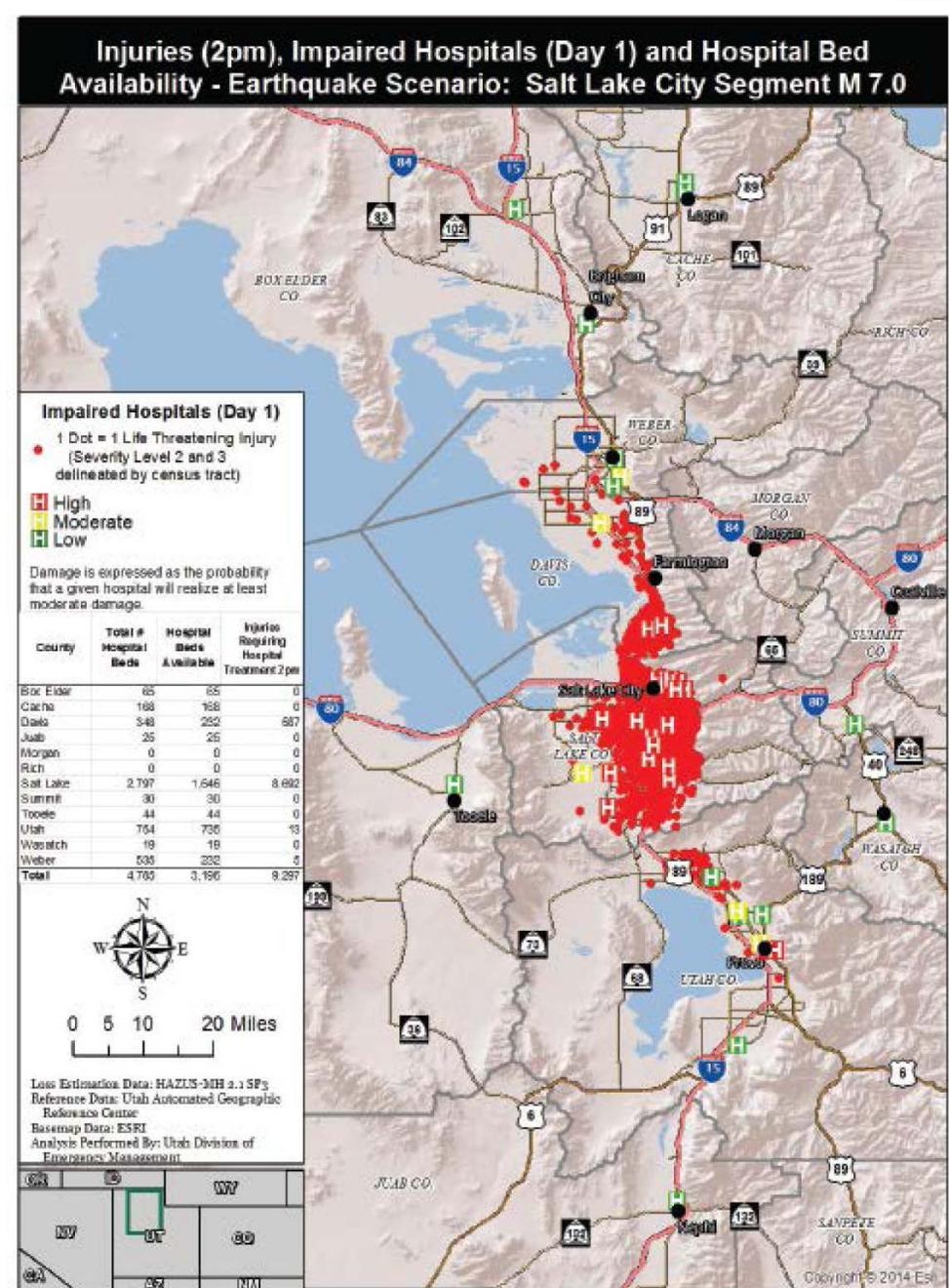


Figure 30. This map illustrates the relationship of injuries to damaged hospitals. Planners using the highway bridge and road segment map and the impaired hospital and injury map can develop strategies on how best to move patients to area hospitals or out-of-area hospitals.

Prepared to RESPOND

Lifelines

Utility System Performance

	Day 1	Day 3	Day 7	Day 30	Day 90
Households without Potable Water	483,600	466,100	442,800	362,900	332,800
Households without Electricity	444,600	251,200	105,900	27,300	800

Transportation

Impaired [‡] Roads	*
Impaired [§] Bridges	595 out of 1,805

[‡] At least "moderate" damage—or several inches of settlement or offset of the ground.

[§] At least "moderate" damage—or column cracking or chipping, movement of the abutment, settlement of the approach, etc., but where the columns are structurally sound.

Debris Generated

Tons	21,000,000
Truckloads (25 tons/truck)	821,600

* Insufficient data for Hazus calculation

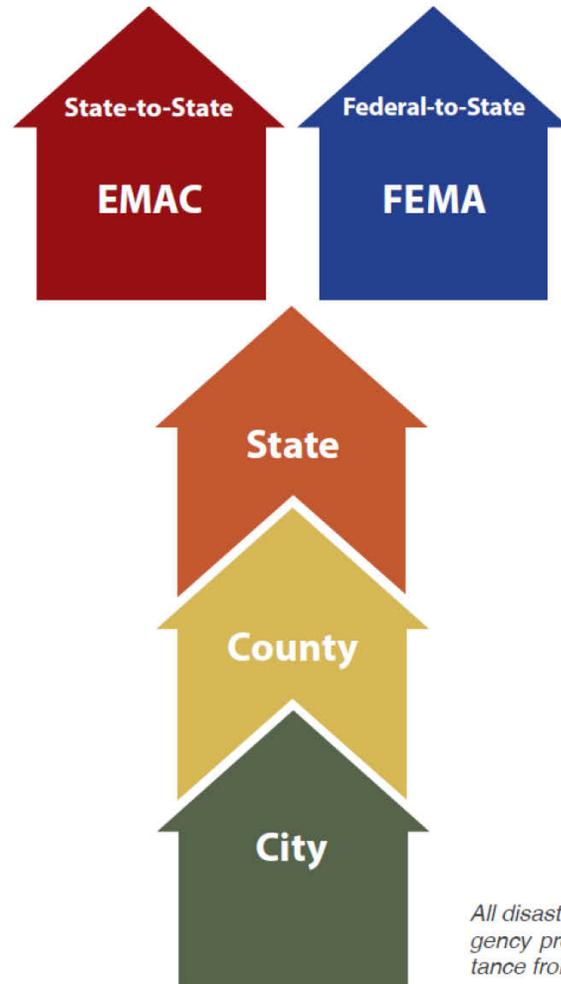
Prepared to RESPOND

Prepared to RESPOND

- Understand the Scope of Needed Response
- Prepare to be Without Utilities
- Exercise for Response
- Prepare for Building Inspection
- Adopt Policies to Get Businesses, Schools and Essential Services Back Into Their Buildings

Prepared to RESPOND

Mutual Aid Agreements



Additional Response and Recovery Resources:

- **National Disaster Recovery Framework** designed to meet the needs of states and communities in their recoveries
- **Public Assistance Grant Program** provides assistance to State, Tribal and local governments
- **Individual and Household Program** provides assistance for individuals with limited resources
- **Community Emergency Response Teams** provide neighborhood teams for local response
- **Disaster Recovery Center** provides recovery services for individuals

All disasters start at the local level. Through the declaration of emergency process, lower level jurisdictions can request disaster assistance from the next higher level of government.

Prepared to RECOVER

► Recovery will take years and even a decade for some things

► Recovery will exceed 33 **B**illion dollars

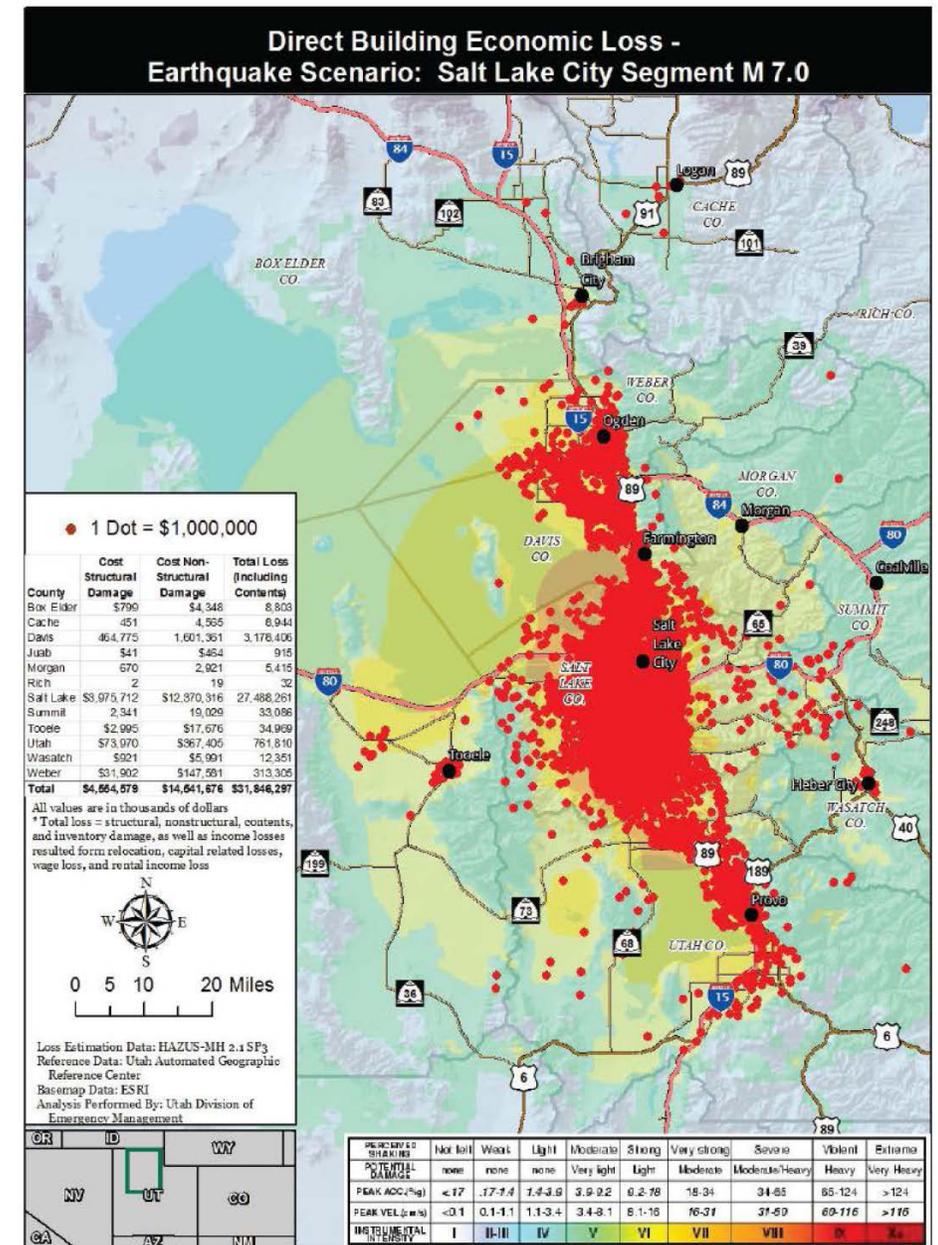


Figure 33. This map provides monetary estimates of losses for building damage across all categories of buildings. Each dot represents an estimated \$1 million in building damage per census tract. When the dollar value falls below this level, there will be no indication of any dollar losses on the map. However, there may be many more areas that have losses that do not appear on the map. For these areas, refer to the table on the map.

Prepared to RECOVER

- ▶ Ounce of Preparation = Pound of Response & Recovery



Prepared to RECOVER

- ▶ Damage Resistant Buildings = Less \$ spent in recovery & Helps keep Businesses in Business
- ▶ Educate public on the benefits of more robust building design

Prepared to RECOVER

- ▶ Develop Business (or government, or school) Continuity Plans

<http://www.utah.gov/beready/business/>

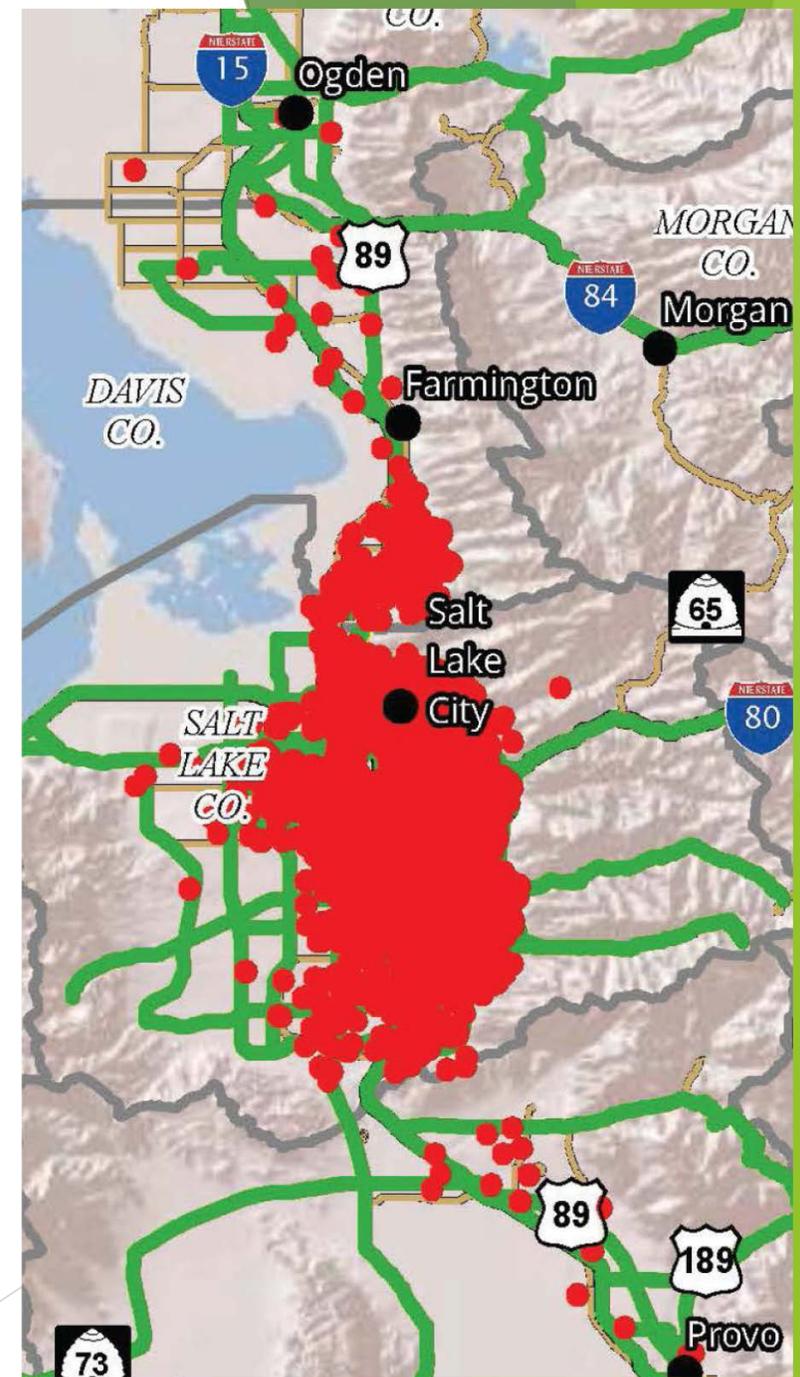
Prepared to RECOVER

- ▶ Establish laws, rules, and Ordinances that address issues related to recovery.

Prepared to RECOVER

- Where will we put the debris?

Each dot represents 5,000 tons (10 million pounds) of debris



Prepared to RECOVER

- ▶ How will essential utilities and services be restored?
- ▶ Roadways
- ▶ Power
- ▶ Water
- ▶ Natural gas
- ▶ Sewage
- ▶ Communications

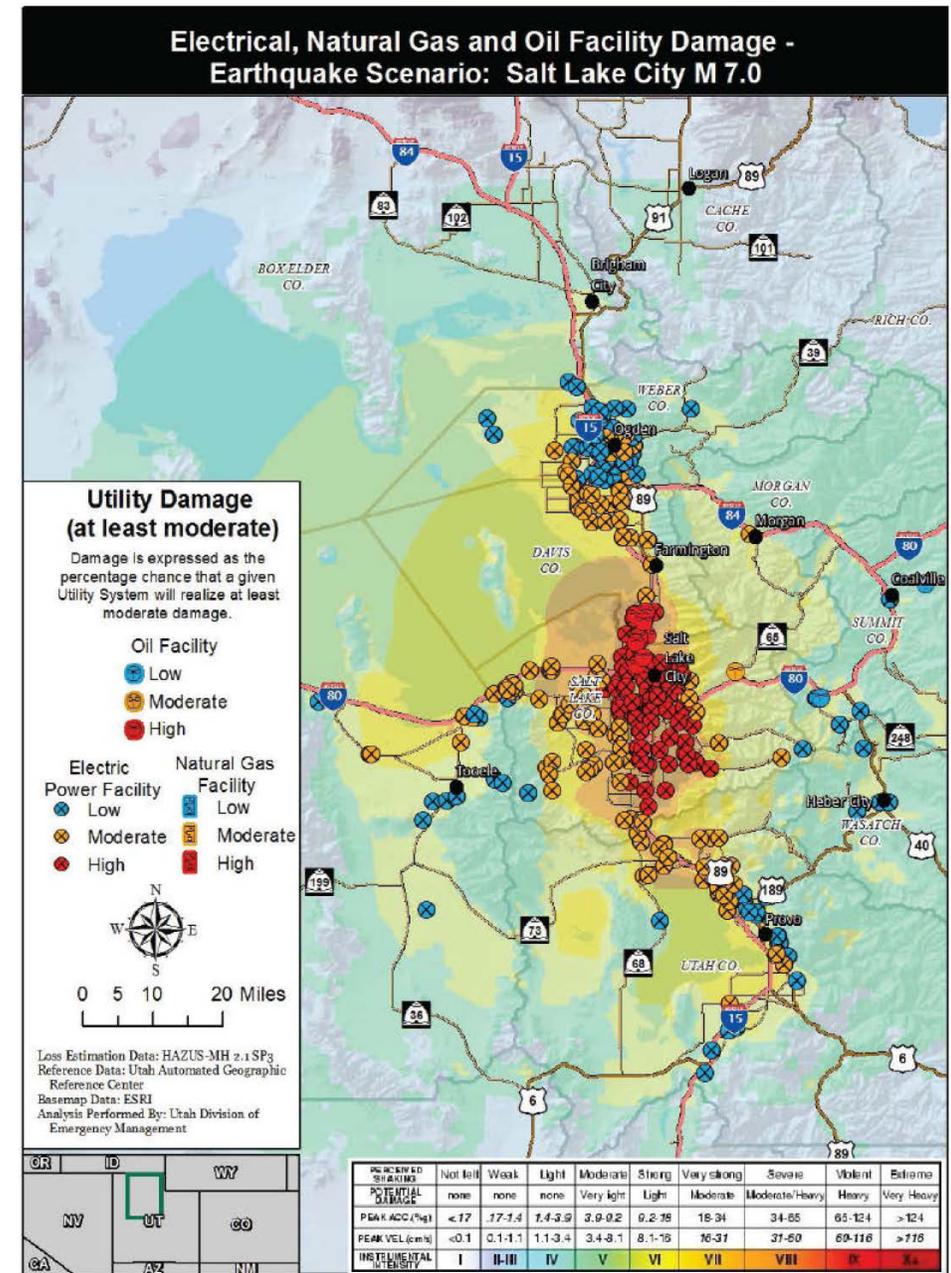
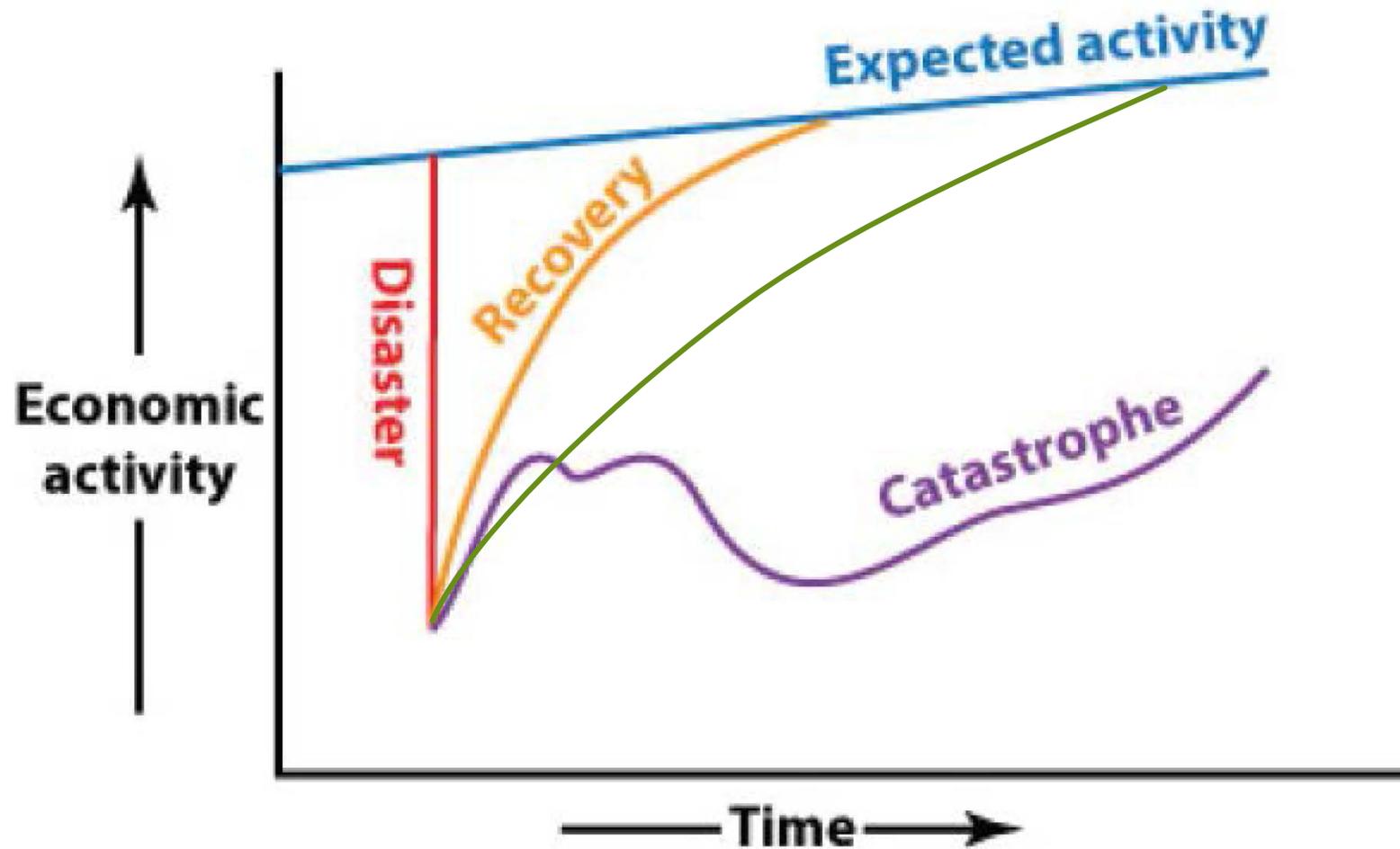


Figure 34. This map represents the probability of at least moderate damage to the electric, natural gas, and oil facilities. The map does not show damage to the different distribution systems.

How will the estimated economic losses of more than \$33 billion be dealt with? How will the state cope with added long-term losses to its economic and social health? What will be done to keep large employers who have operations elsewhere from leaving? How are residents going to be able to take care of themselves if their businesses, or the companies they work for, are no longer viable? Our scenario does not seek to answer such questions but raises them to motivate pre-disaster planning at all levels of government.

Which line will we take to recovery?
Be PREPARED to prevent catastrophe!



Download from

Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault–Salt Lake City Segment

Hazards and Loss Estimates

- ▶ <http://utah.eeri.org>
- ▶ <http://USSC.utah.gov>



Developed by the
Earthquake Engineering Research Institute,
Utah Chapter



Prepared for the
Utah Seismic Safety Commission

June 4, 2015