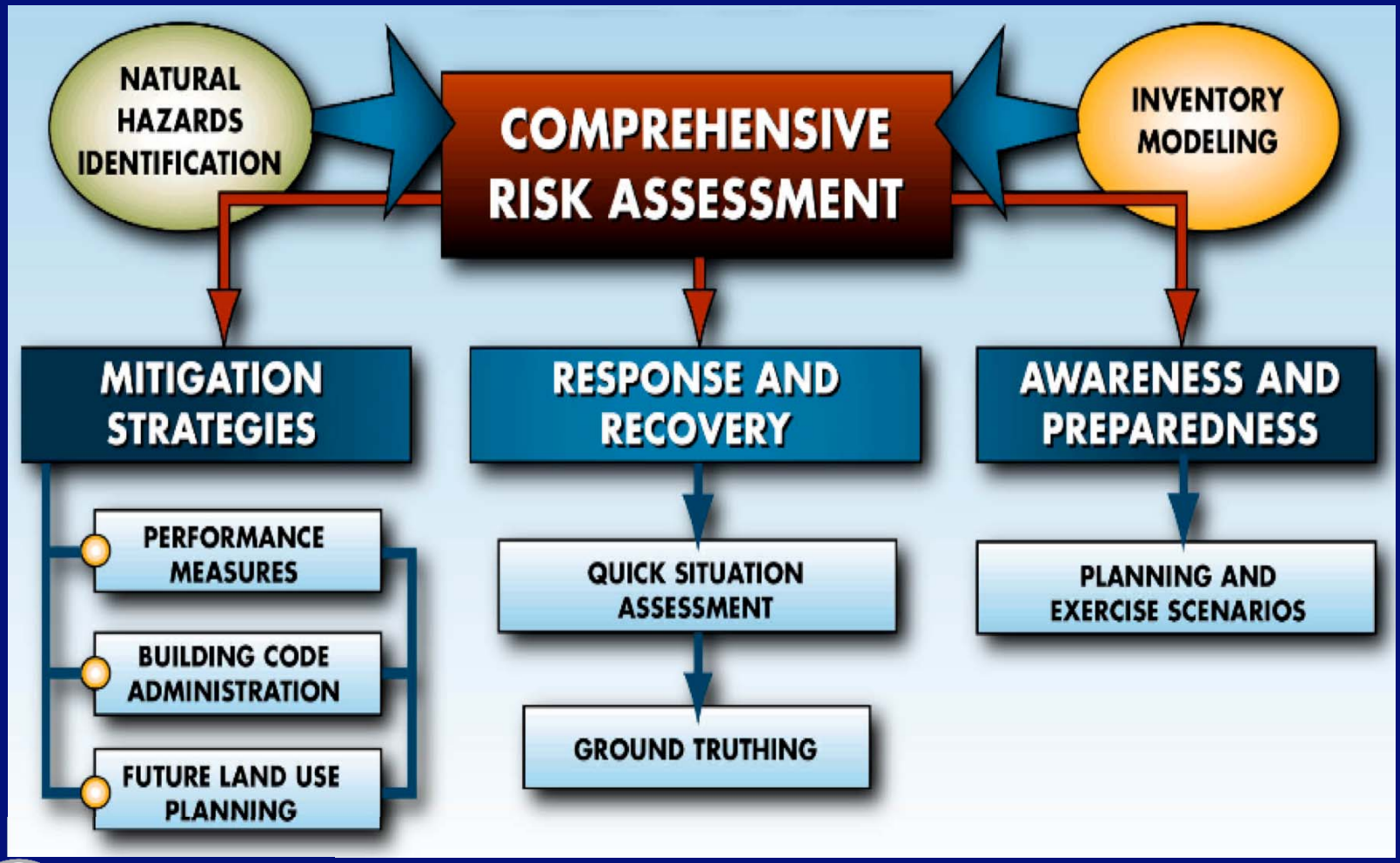
New Madrid -- Wasatch

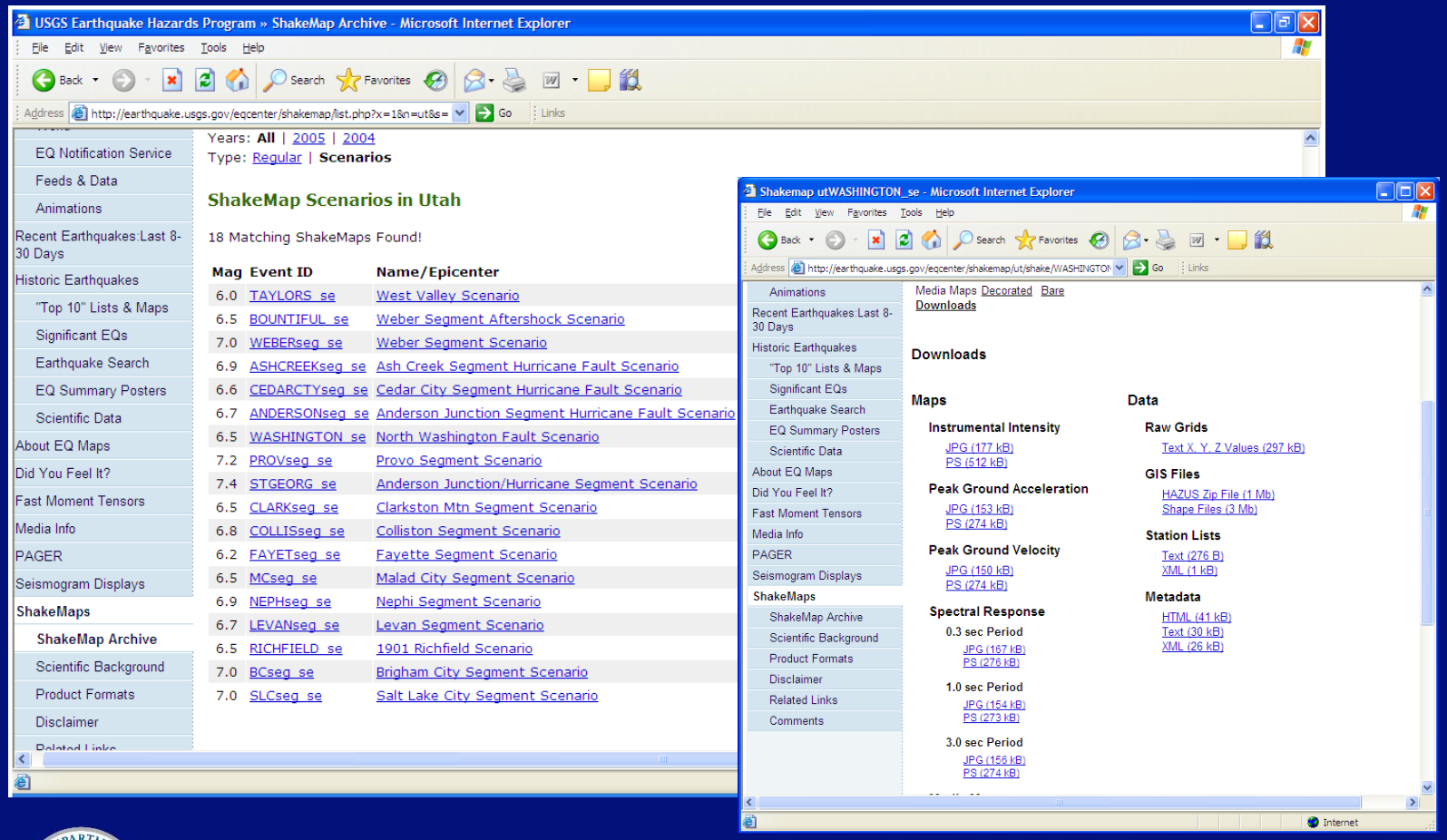
HAZUS Applications for Catastrophic Planning

FEMA

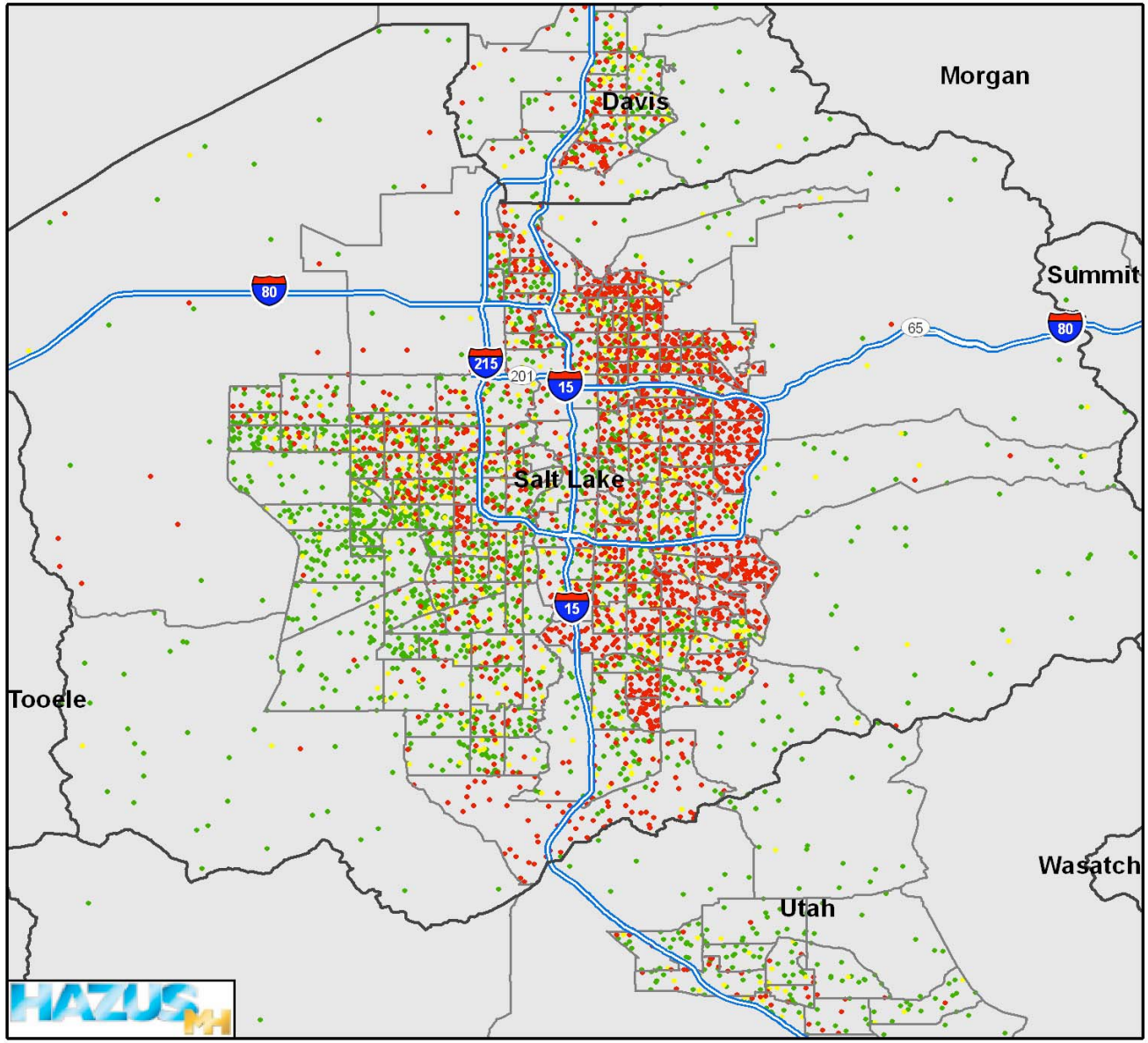
HAZUS Applications



UofU Suite of ShakeMap Scenarios



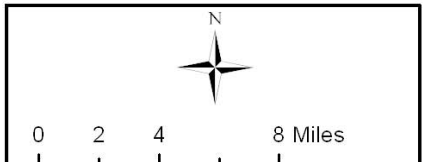
Estimated Building Inspection Needs - Earthquake Scenario: Wasatch Front



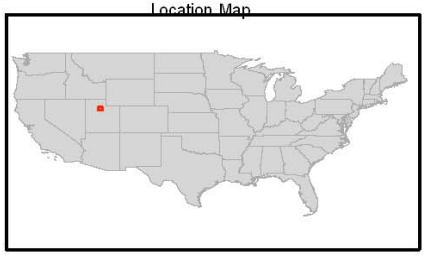
Wasatch Front Magnitude 7.0

	Estimated # of Structures
Red (Complete)	119,219
Yellow (Extensive)	41,219
Green (Slight/ Moderate)	159,701
TOTAL	320,139

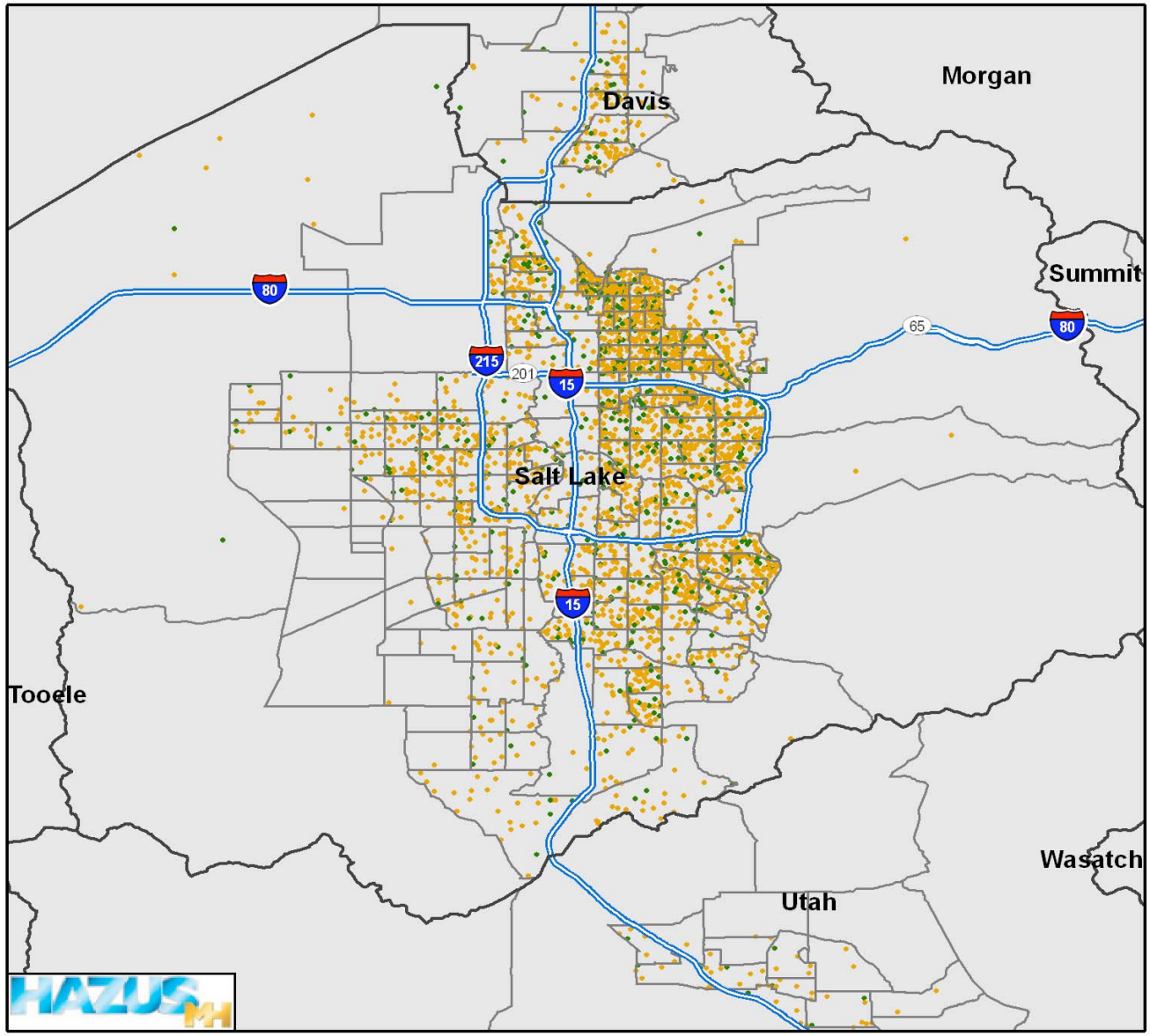
1 Dot = 50 Structures
Red Tag (Complete Damage)
1 Dot = 50 Structures
Yellow Tag (Extensive Damage)
1 Dot = 50 Structures
Green Tag (Slight/Moderate Damage)
County Boundaries
State Boundaries



Location Map



Estimated Displaced Households & Short-Term Public Shelter Needs - Earthquake Scenario: Wasatch Front



Wasatch Front Magnitude 7.0

	Total #
Public Shelter Needs (Individuals)	34,284
Displaced Households	151,375

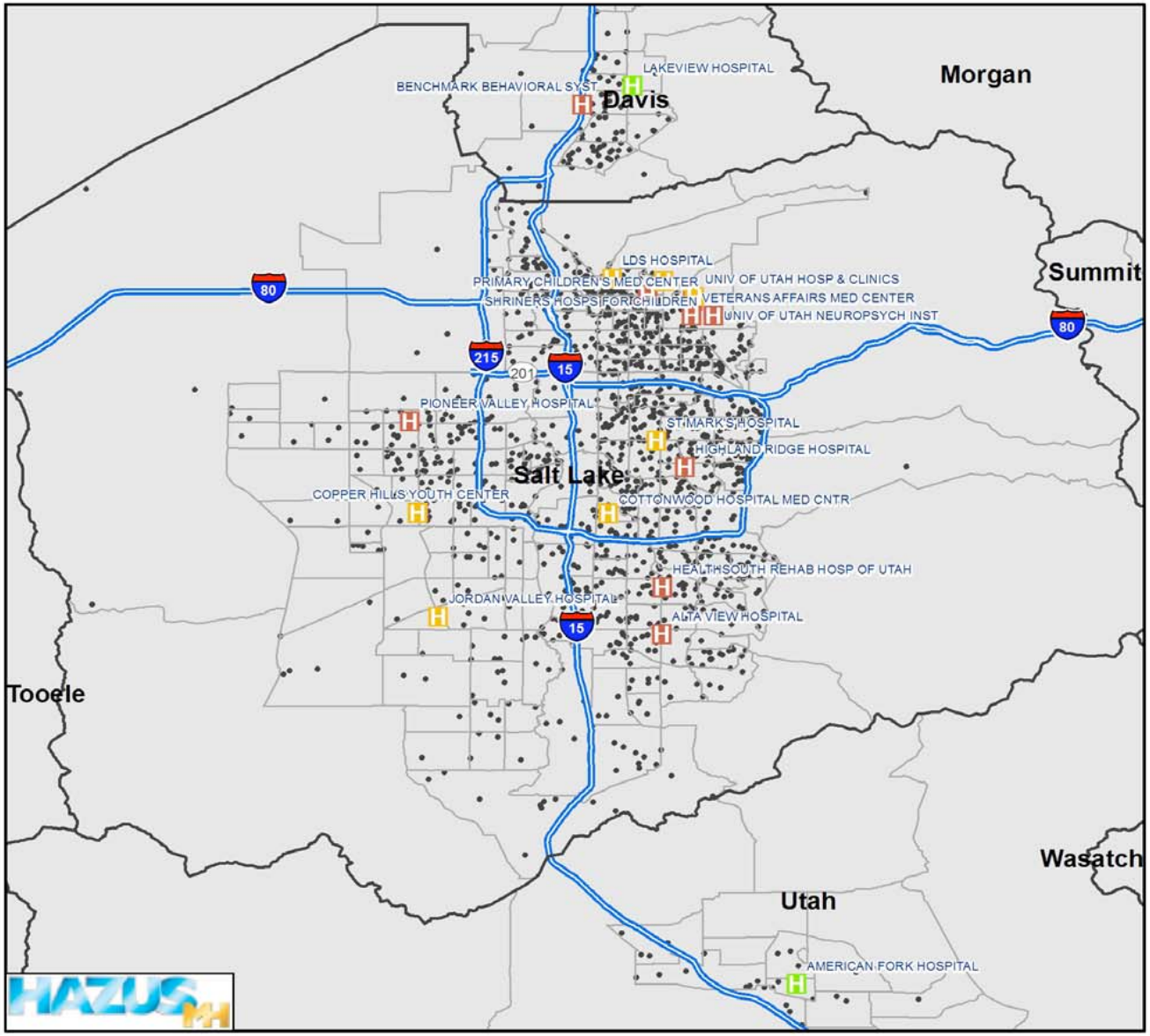
1 Dot = 50
Public Shelter Needs (Individuals)
Displaced Households
County Boundaries
State Boundaries

N

0 2 4 8 Miles

Location Map

Estimated Casualties (Severity 3) & Hospital Functionality - Earthquake Scenario: Wasatch Front



Wasatch Front
Magnitude 7.0 - 2:00PM

1 Dot = 5 Persons

Life-Threatening Injury

Impaired Hospitals (Day 1)

Damage is expressed as the percentage chance that a given hospital will be functional on Day 1.

- < 10%
- 10 - 25%
- 25 - 50%
- 50 - 75%
- > 75%

County Boundaries

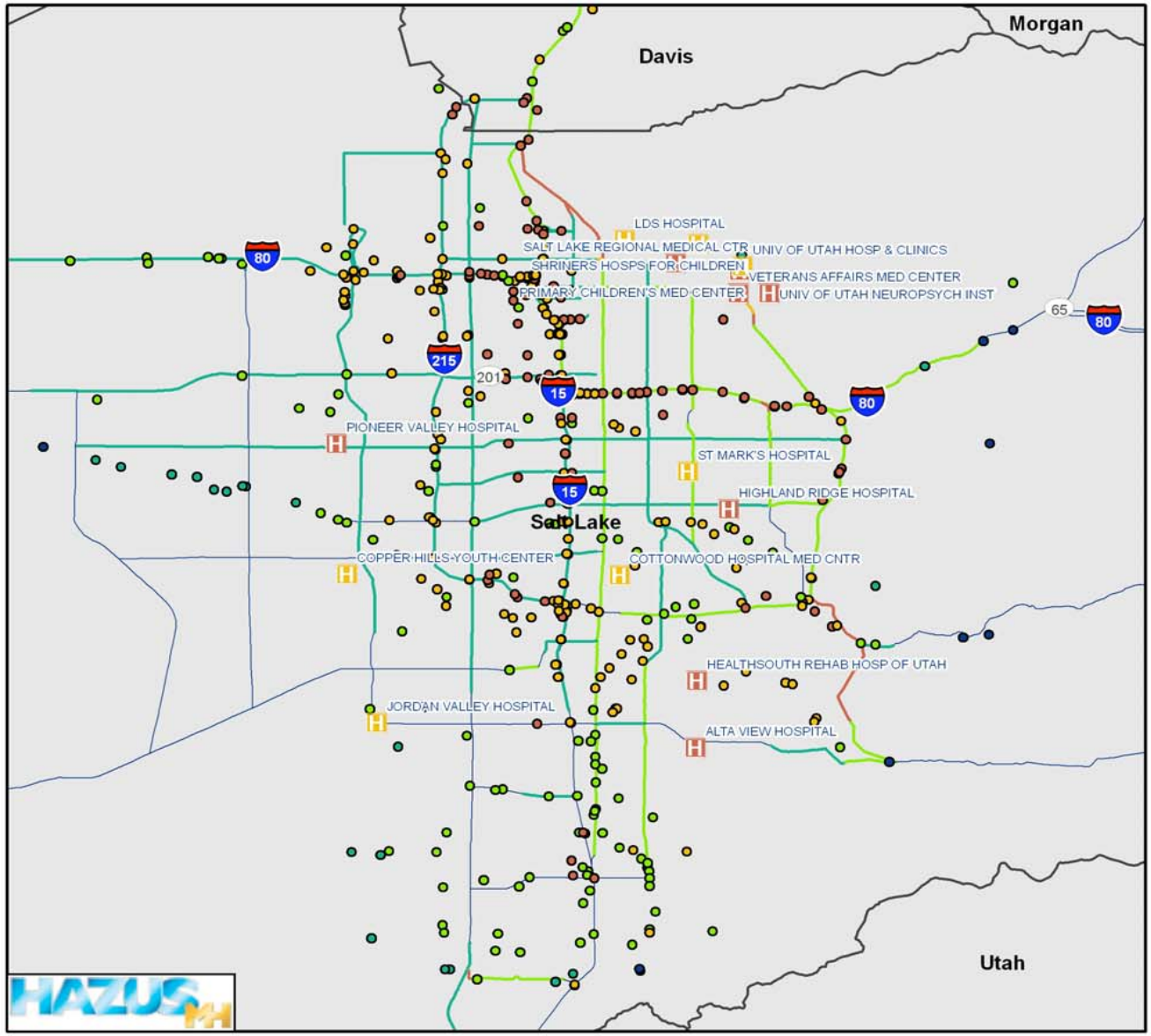
State Boundaries

N

0 2 4 8 Miles

Location Map

Estimated Highway Infrastructure Damage & Hospitals - Earthquake Scenario: Wasatch Front



Wasatch Front Magnitude 7.0

Major Roadway Bridge Damage
Damage is expressed as the percentage chance that a given roadway bridge will realize at least moderate damage

- < 10%
- 10 - 25%
- 25 - 50%
- 50 - 75%
- > 75%

Highway Segment Damage
Damage is expressed as the percentage chance that a given highway segment will realize at least moderate damage

- < 10%
- 10 - 25%
- 25 - 50%
- 50 - 75%
- > 75%

Impaired Hospitals (Day 1)
Damage is expressed as the percentage chance that a given hospital will be functional on Day 1.

- < 10%
- 10 - 25%
- 25 - 50%
- 50 - 75%
- > 75%

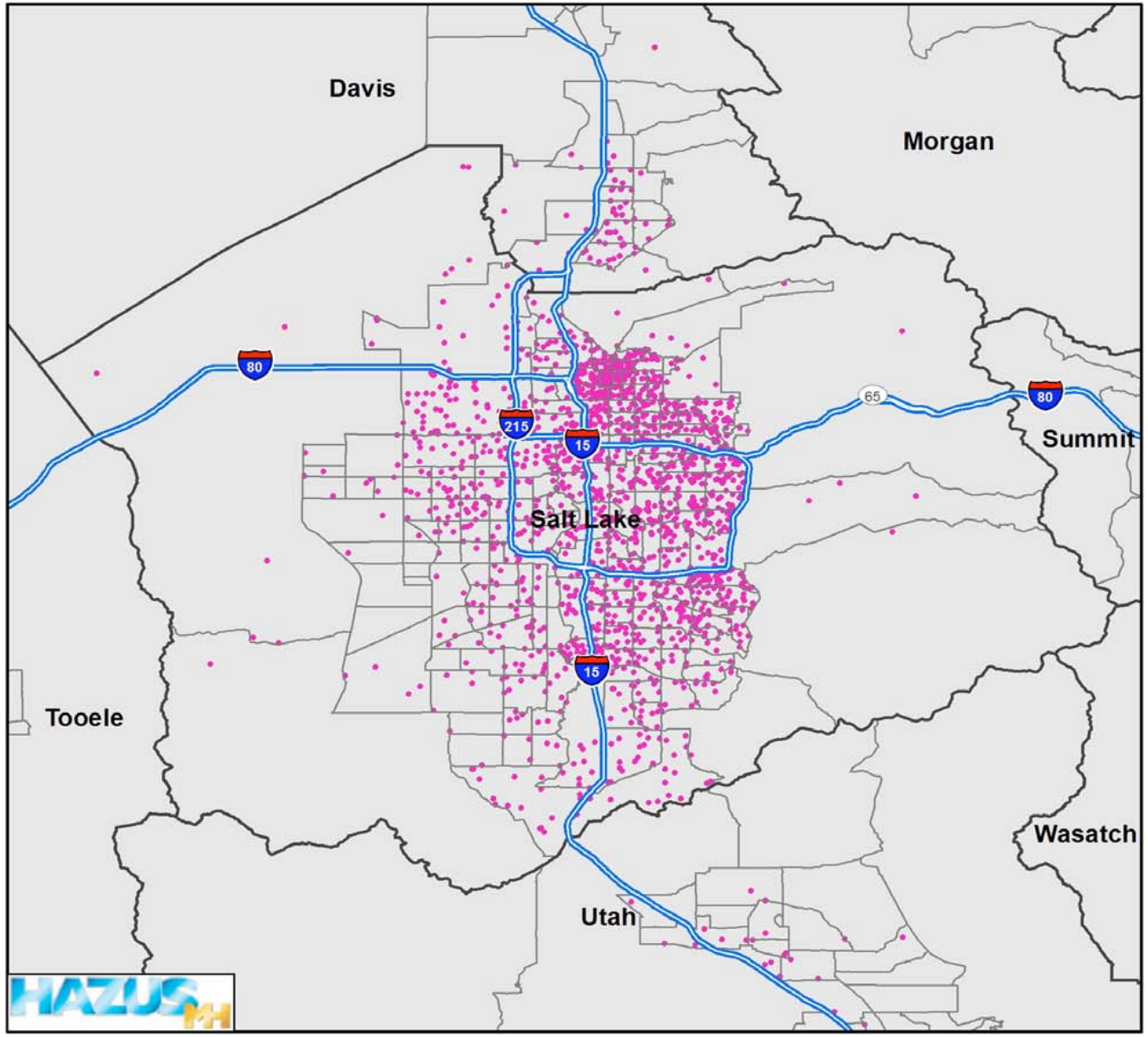
County Boundaries
State Boundaries

N

0 1 2 4 Miles

Location Map

Estimated Concrete and Steel Debris - Earthquake Scenario: Wasatch Front



Wasatch Front
Magnitude 7.0

1 Dot = 10 Tons
Concrete & Steel Debris
County Boundaries
State Boundaries

N

0 2 4 8 Miles

Location Map

Wasatch Front-SLC Segment Building Damage Counts

Major Inspection Needs:
Salt Lake
Davis
Utah
and
Weber counties
(2,000 inspectors, 30 days)

	Damage Categories					
	None	Slight	Moderate	Extensive	Complete	Total
Box Elder	12,202	107	54	11	2	12,376
Davis	34,039	12,093	8,173	3,822	6,819	64,946
Morgan	1,776	209	100	22	3	2,111
Salt Lake	28,133	44,203	55,437	31,532	108,590	267,895
Summit	14,347	460	87	14	2	14,910
Tooele	9,571	1,457	868	292	93	12,281
Utah	53,266	13,868	8,453	3,136	2,877	81,599
Wasatch	5,497	313	92	16	2	5,919
Weber	40,108	7,843	5,609	2,375	1,215	57,151
Total State	**252,194**	**80,554**	**78,872**	**41,220**	**119,602**	**572,442**

Tabular Results
Can be by Building Type

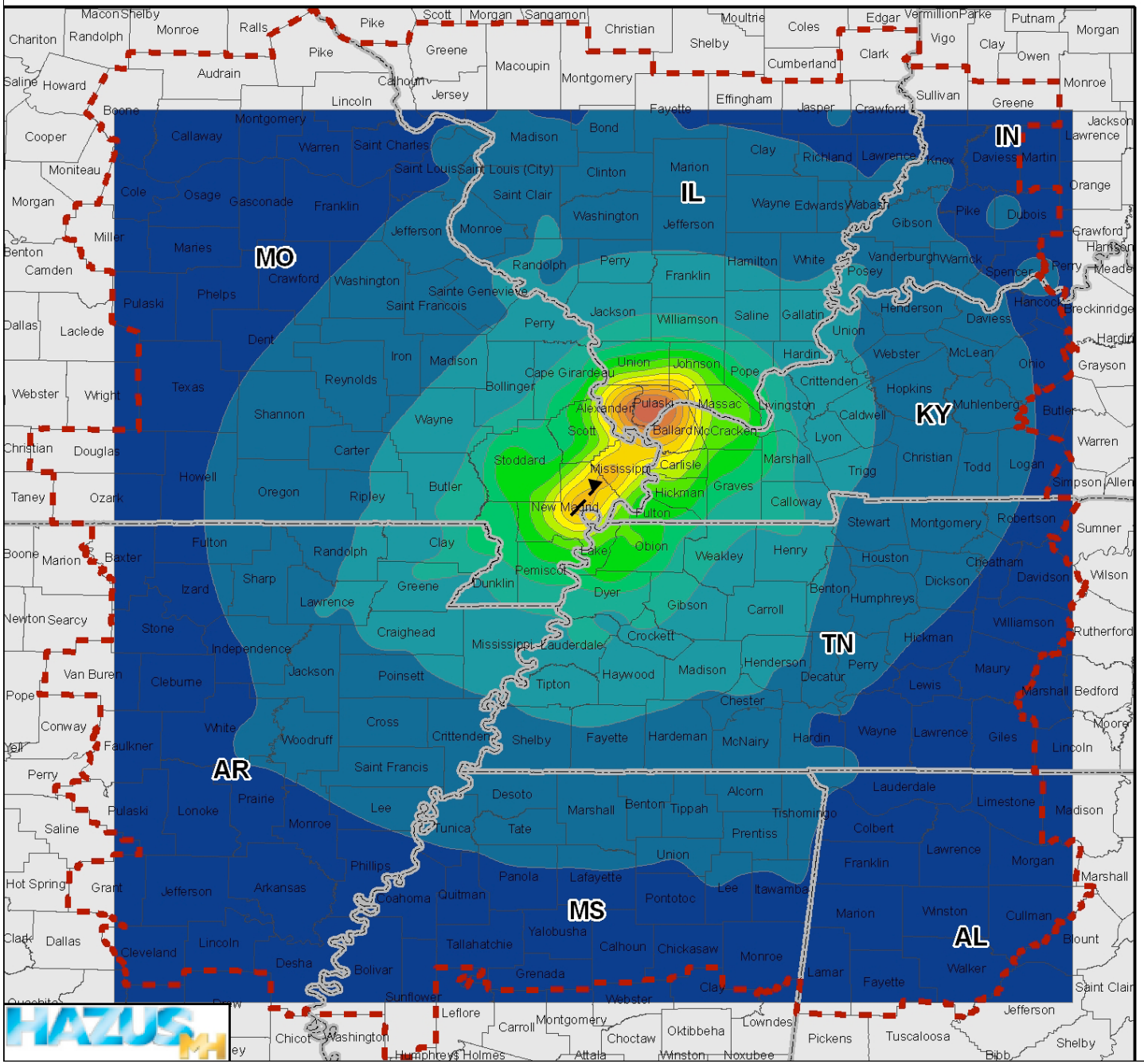
Time of Day	**Daytime**
Severity 3 & 4 Casualties w/ out URMs*	2,500
Severity 3 & 4 Casualties w/ URMs	8,800
% Casualties Caused by URMs	70%

**note: Severity 3 and 4 include life-threatening casualties and fatalities, respectively*

NMSZ Baseline Scenarios

- 3 1811-12 Characteristic Scenarios supplied by USGS Memphis
- Ground motion product analogous to USGS ShakeMap
- Liquefaction susceptibility based on CUSEC State Geologists' soils mapping

Peak Ground Acceleration & Source - Earthquake Scenario: New Madrid Region



Northeast Scenario
Magnitude 7.7

PGA

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- 1.0 - 1.1
- 1.1 - 1.2
- 1.2 - 1.3
- > 1.3

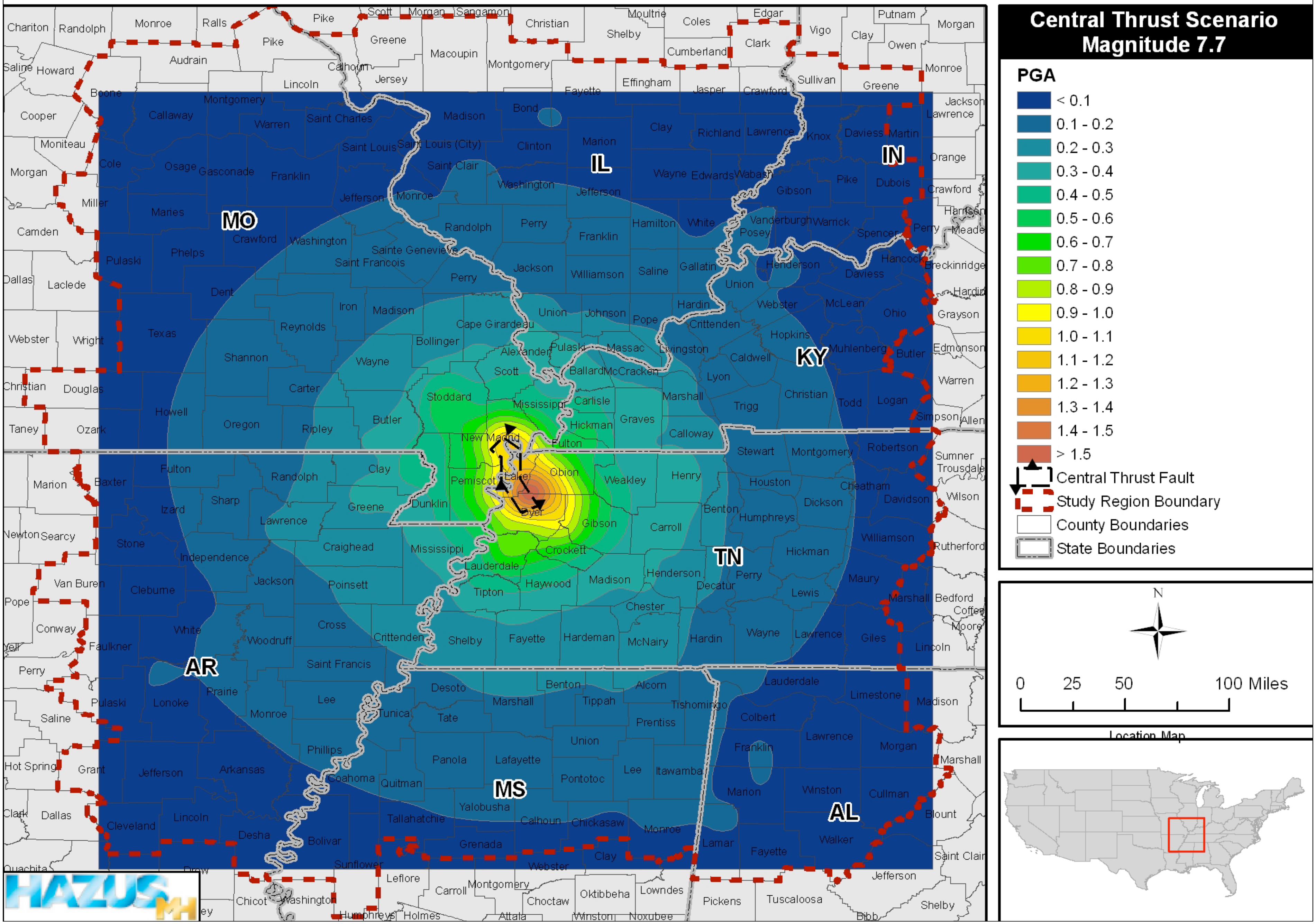
Thrust Fault - NE Segment
Study Region Boundary
County Boundaries
State Boundaries

N

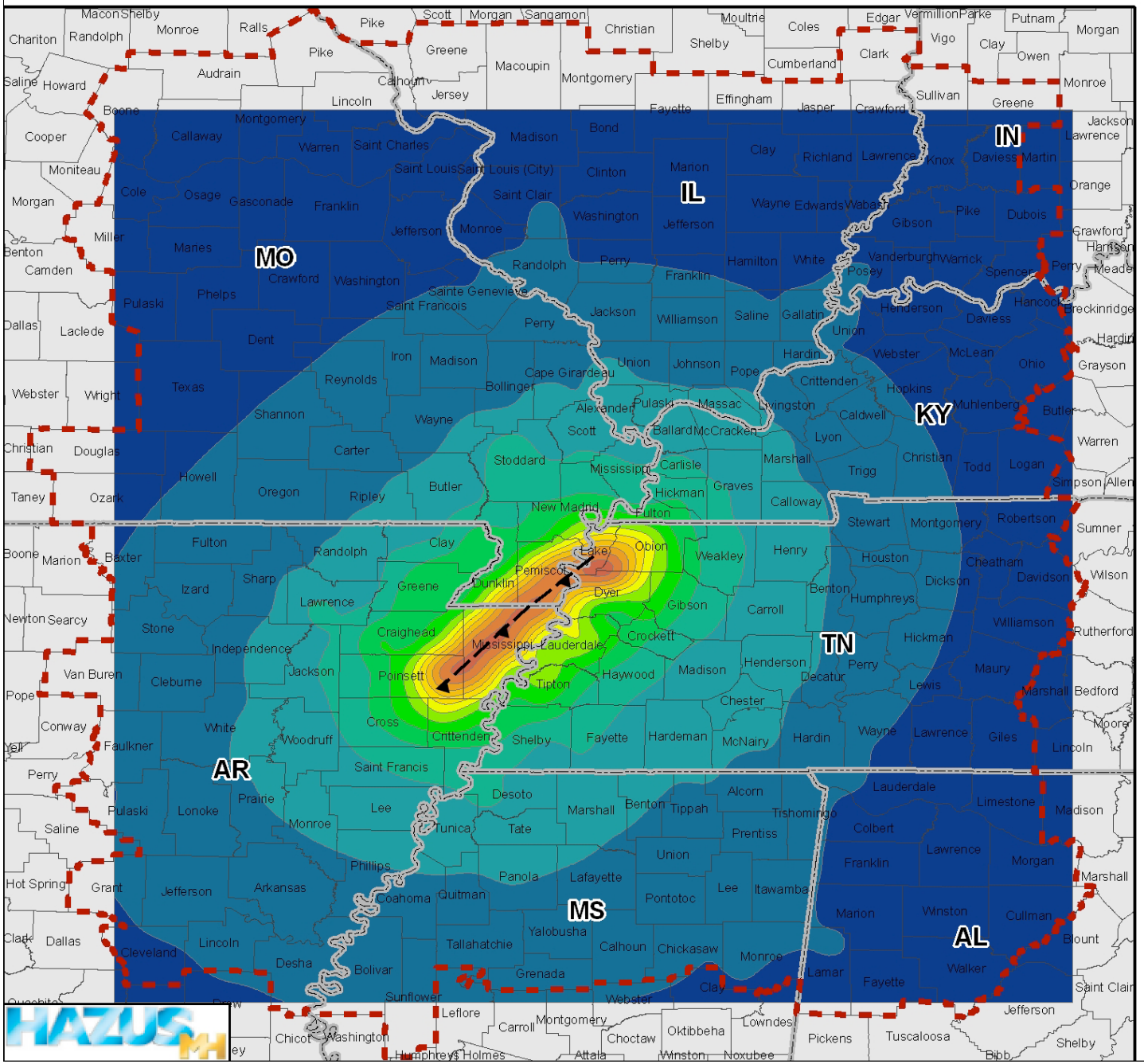
0 25 50 100 Miles

Location Map

Peak Ground Acceleration - Earthquake Scenario: New Madrid Region



Peak Ground Acceleration & Source - Earthquake Scenario: New Madrid Region



Southwest Scenario
Magnitude 7.7

PGA

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- 0.5 - 0.6
- 0.6 - 0.7
- 0.7 - 0.8
- 0.8 - 0.9
- 0.9 - 1.0
- 1.0 - 1.1
- 1.1 - 1.2
- > 1.2

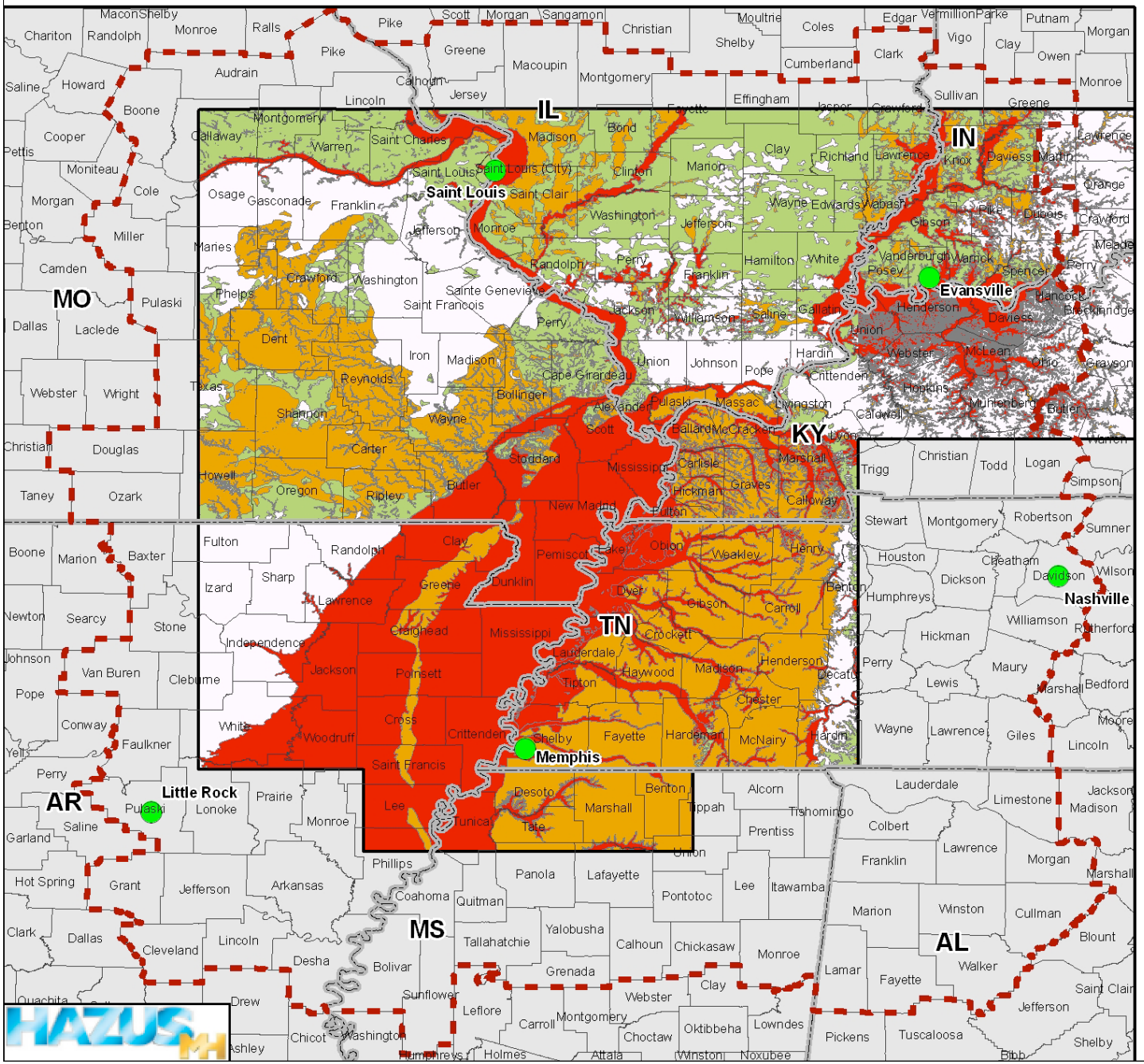
Thrust Fault - SW Segment
Study Region Boundary
County Boundaries
State Boundaries

N

0 25 50 100 Miles

Location Map

Liquefaction Susceptibility - Earthquake Scenario: New Madrid Region



New Madrid Scenario
Magnitude 7.7

Liquefaction Susceptibility

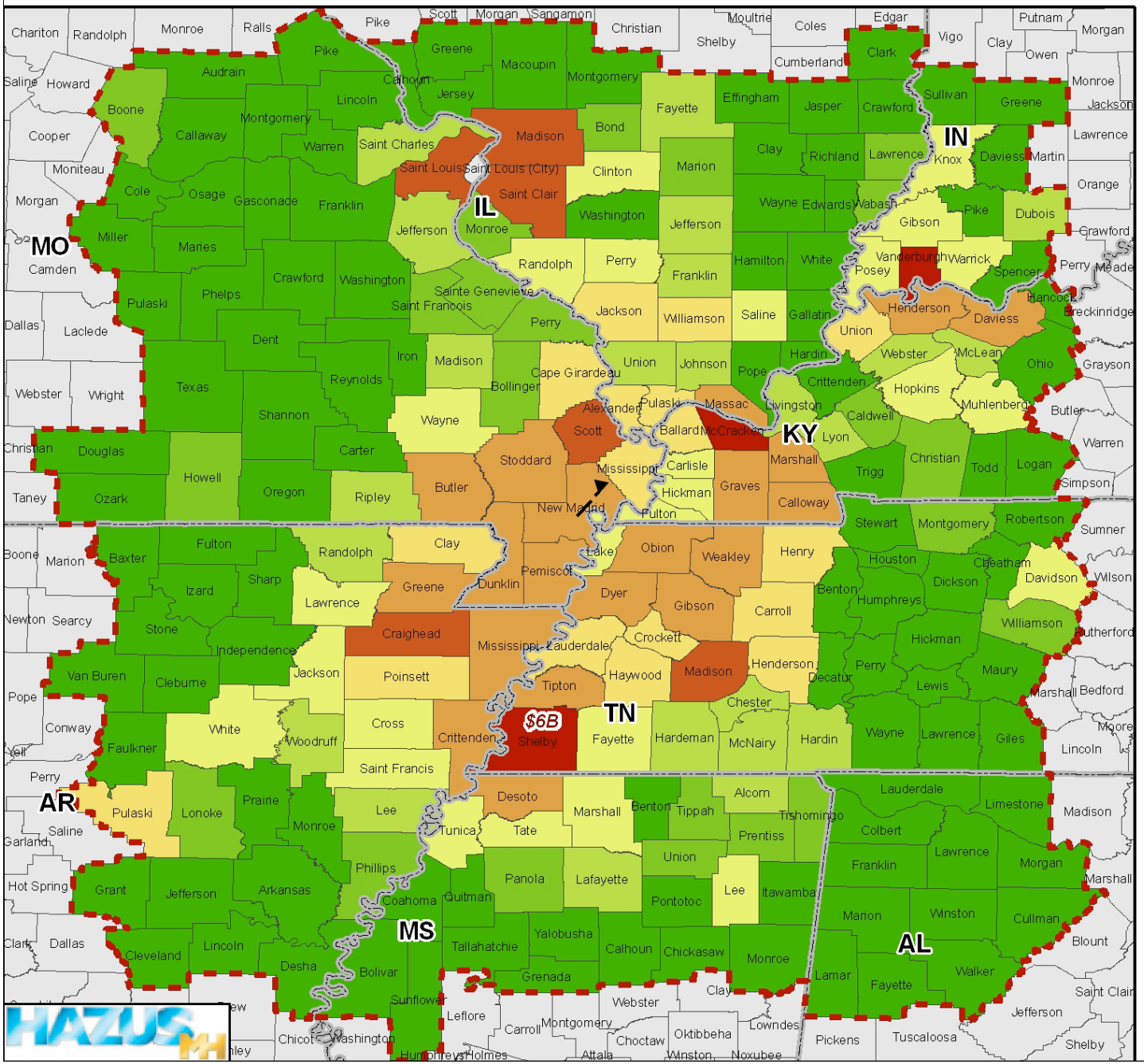
- None
- Very Low
- High
- Very High
- Major Cities
- Study Region Boundary
- County Boundaries
- State Boundaries

N

0 25 50 100 Miles

Location Map

Estimated Total County Building Loss - Earthquake Scenario: New Madrid Region



Northeast Scenario
Magnitude 7.7

Direct Economic Losses ($M)
(Losses are expressed in Millions of dollars and include all building related losses)

- < 25
- 25 - 50
- 50 - 100
- 100 - 250
- 250 - 500
- 500 - 1,000
- 1,000 - 2,000
- > 2,000

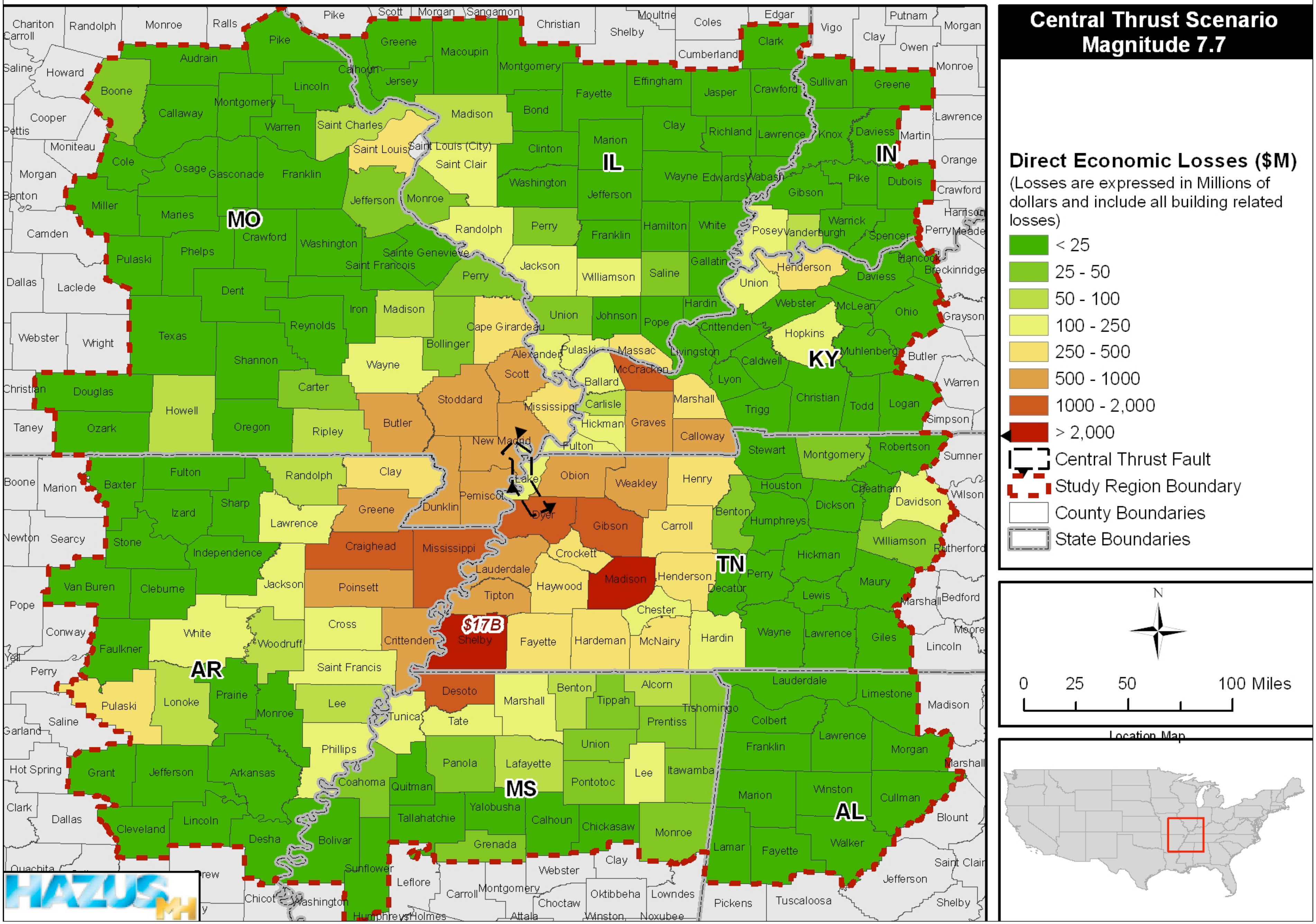
Thrust Fault - NE Segment
Study Region Boundary
County Boundaries
State Boundaries

N

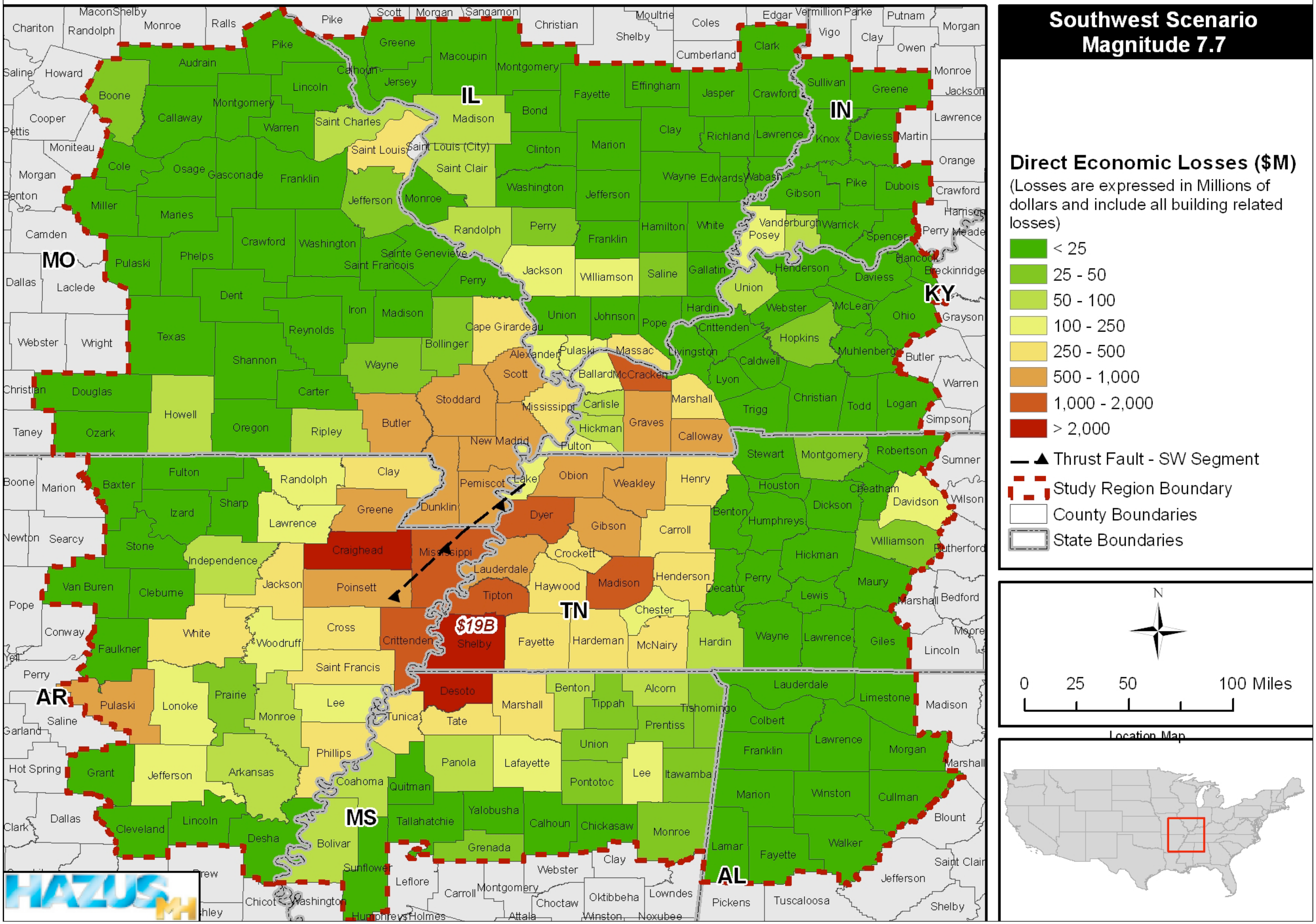
0 25 50 100 Miles

Location Map

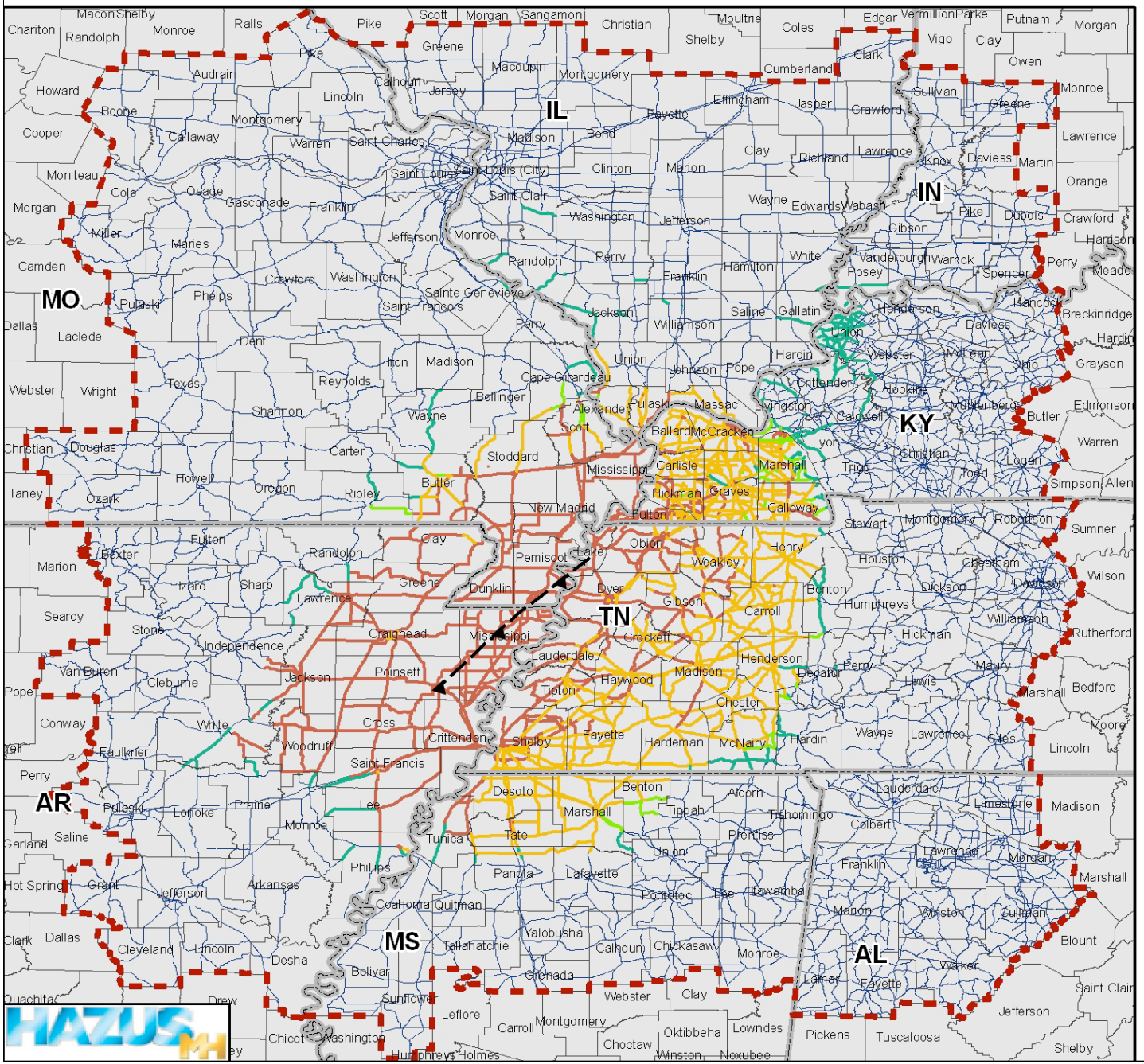
Estimated Total County Building Loss - Earthquake Scenario: New Madrid Region



Estimated Total County Building Loss - Earthquake Scenario: New Madrid Region



Estimated Highway Segment Damage - Earthquake Scenario: New Madrid Region



Southwest Scenario
Magnitude 7.7

Probability of Moderate Damage
(Damage is expressed as the percentage chance that a given highway segment will realize at least moderate damage)

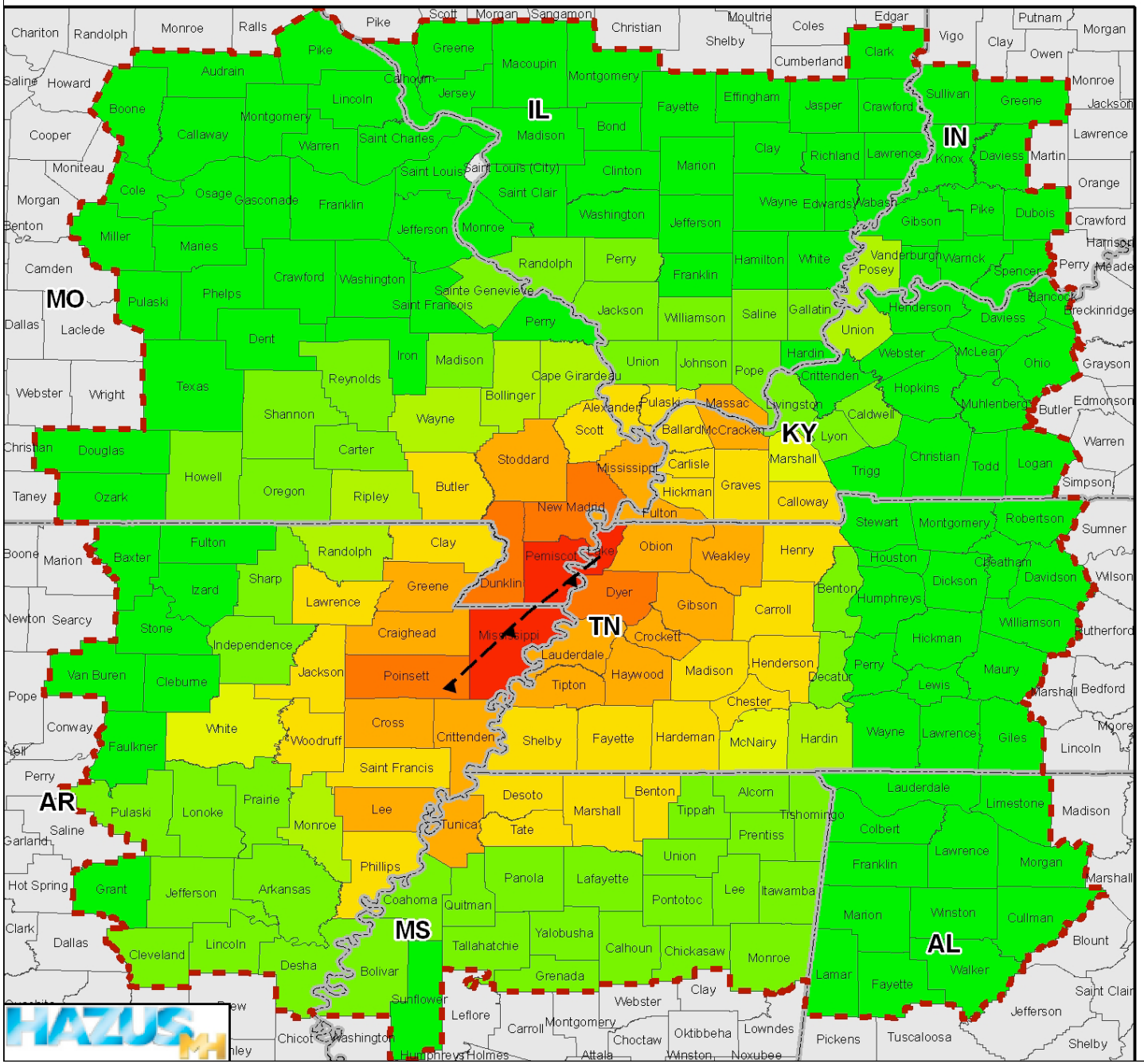
- < 1%
- 1 - 5%
- 5 - 10%
- 10 - 20%
- 20 - 30%
- Thrust Fault - SW Segment
- Study Region Boundary
- County Boundaries
- State Boundaries

N

0 25 50 100 Miles

Location Map

Estimated County Building Loss Ratios - Earthquake Scenario: New Madrid Region



Southwest Scenario Magnitude 7.7

Building Loss Ratio

(Losses are expressed as a percentage of total building replacement value. Community Sustainability is generally considered at risk when losses exceed 10% of the built environment)

- < 1
- 1 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- > 50
- Thrust Fault - SW Segment
- Study Region Boundary
- County Boundaries
- State Boundaries

N

0 25 50 100 Miles

Location Map

New Madrid Baseline

Scenario	Bldg	Trans	Util.	Total
NE Segment	$49.2	$6.3	$12.5	$68.0
RT Segment	$52.6	$6.7	$11.0	$70.3
SW Segment	$57.8	$7.3	$12.0	$77.1

Liquefaction Induced Losses Northeast Scenario ($B)

State	AR	IL	IN	KY	MS	MO	TN	Total
No Liquefaction Layer	$1.7	$2.1	$0.3	$4.1	$0.8	$4.3	$5.3	$18.6
With Liquefaction Layer	$6.3	$5.3	$2.9	$8.3	$1.4	$9.9	$7.3	$41.3
% Loss Due to Liquefaction	73%	60%	88%	50%	46%	57%	27%	55%

Mitigation Priorities
Unreinforced Masonry Related Casualties

Time of Day	**Nighttime**	**Daytime**	**Commute**
Severity 2, 3 & 4 Casualties w/ out URMs	1,750	3,750	5,500
Severity 2, 3 & 4 Casualties w/ URMs	16,500	16,550	17,300
% Casualties Caused by URMs	89%	77%	68%

CUSEC Area Suite of Scenarios

- These 1811-12 Characteristic Earthquakes provide worst-case scenarios for TN, AR, KY, SE MO
- Wabash Area Scenario needed for IL, IN, and Southern Illinois SZ for St. Louis, MO
- Moderate southern source zone scenario needed for AL, MS

Other New Madrid Estimates

- Lloyds of London ($74B)
- MAE Center Website ($200B)
- MAE Center Research Publication ($50B)

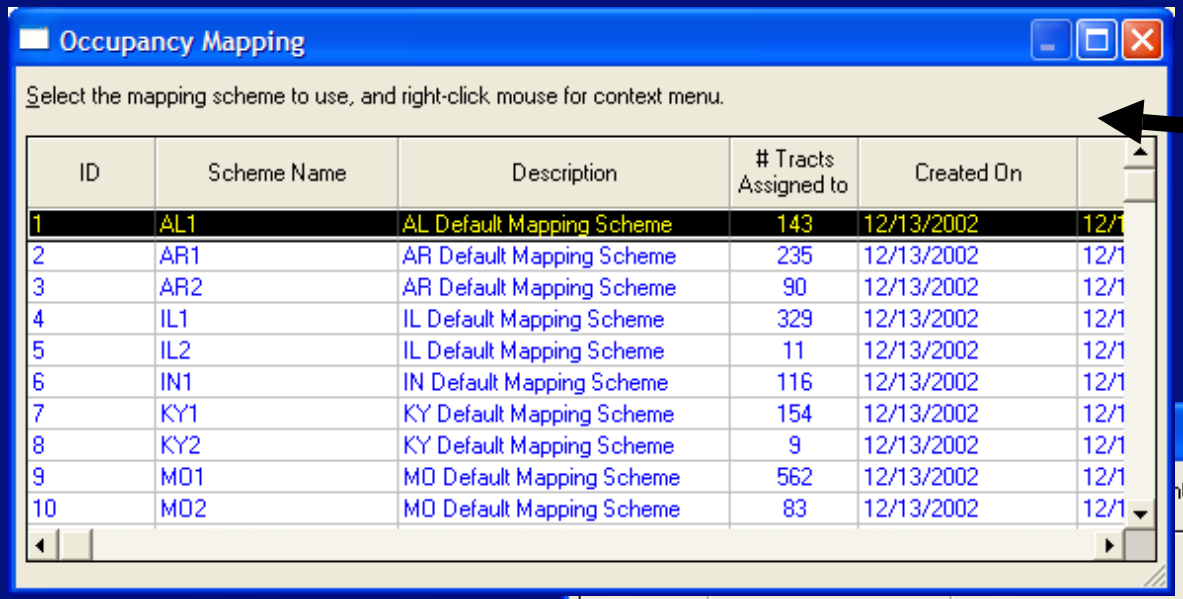
Baseline Scenarios - Observations

- URMs cause most the serious casualties
- Ground failure plays a significant role
- More than 400K households without potable water for 90-days or more (1M/4.2M on day one)
- Major transportation issues over a large geographic area
- 250K displaced households
- 32M tons of debris

Not Assessed/Included in Baseline Scenarios

- *2005 Building Valuations (available in MR-2)*
- *St. Louis and Memphis detailed liquefaction susceptibility*
- *Landslide susceptibility*
- *Refined building occupancy mapping schemes*
- *Review of low and moderate seismic design assignments (will impact economic losses and could significantly increase casualties)*
- *Mississippi River Bridges- large multi $B system*
- *Pipeline/infrastructure direct and indirect losses*
- *Transportation network analysis -- NBI, highway geospatial accuracy limitations – requires State DOT data*
- *Unused inventory attributes - replacement costs – can be refined with other attributes (runway length, number of students, HSIP attributes), total regional annual income, demographics (age, ethnicity, income, homeownership)*
- *No assessor data—(occupancy mapping by decade)*
- *No cascading impacts—levee failures, hazmat releases, dams*

Improve Occupancy Mapping



ID	Scheme Name	Description	# Tracts Assigned to	Created On	
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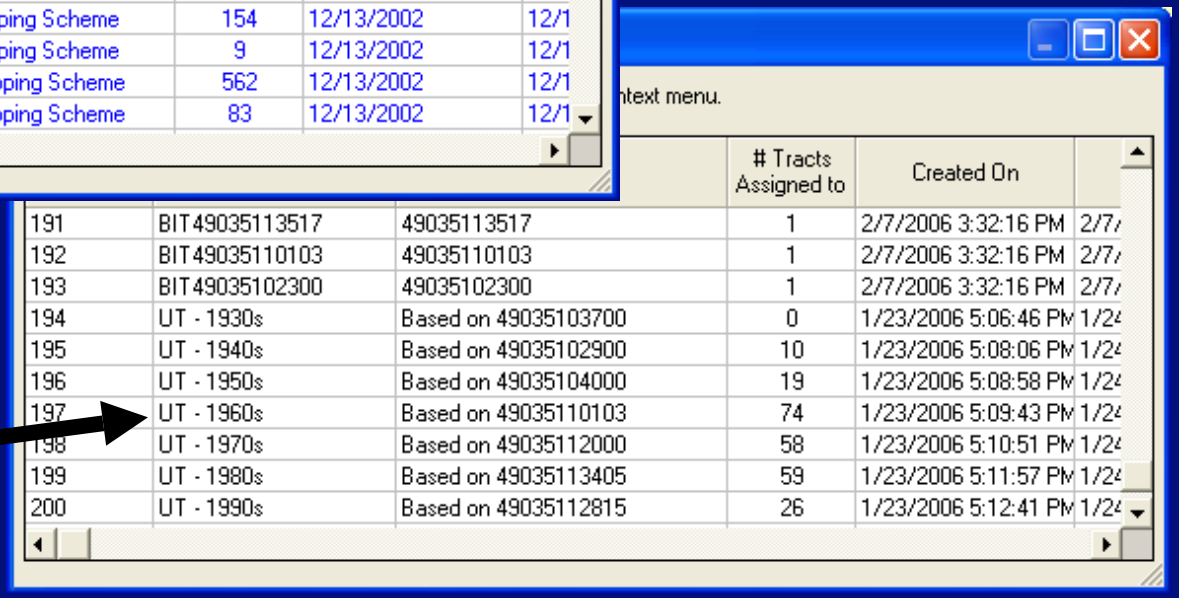
2	AR1	AR Default Mapping Scheme	235	12/13/2002	12/1
3	AR2	AR Default Mapping Scheme	90	12/13/2002	12/1
4	IL1	IL Default Mapping Scheme	329	12/13/2002	12/1
5	IL2	IL Default Mapping Scheme	11	12/13/2002	12/1
6	IN1	IN Default Mapping Scheme	116	12/13/2002	12/1
7	KY1	KY Default Mapping Scheme	154	12/13/2002	12/1
8	KY2	KY Default Mapping Scheme	9	12/13/2002	12/1
9	MO1	MO Default Mapping Scheme	562	12/13/2002	12/1
10	MO2	MO Default Mapping Scheme	83	12/13/2002	12/1

New Madrid- Does not consider median year built, adoption and enforcement



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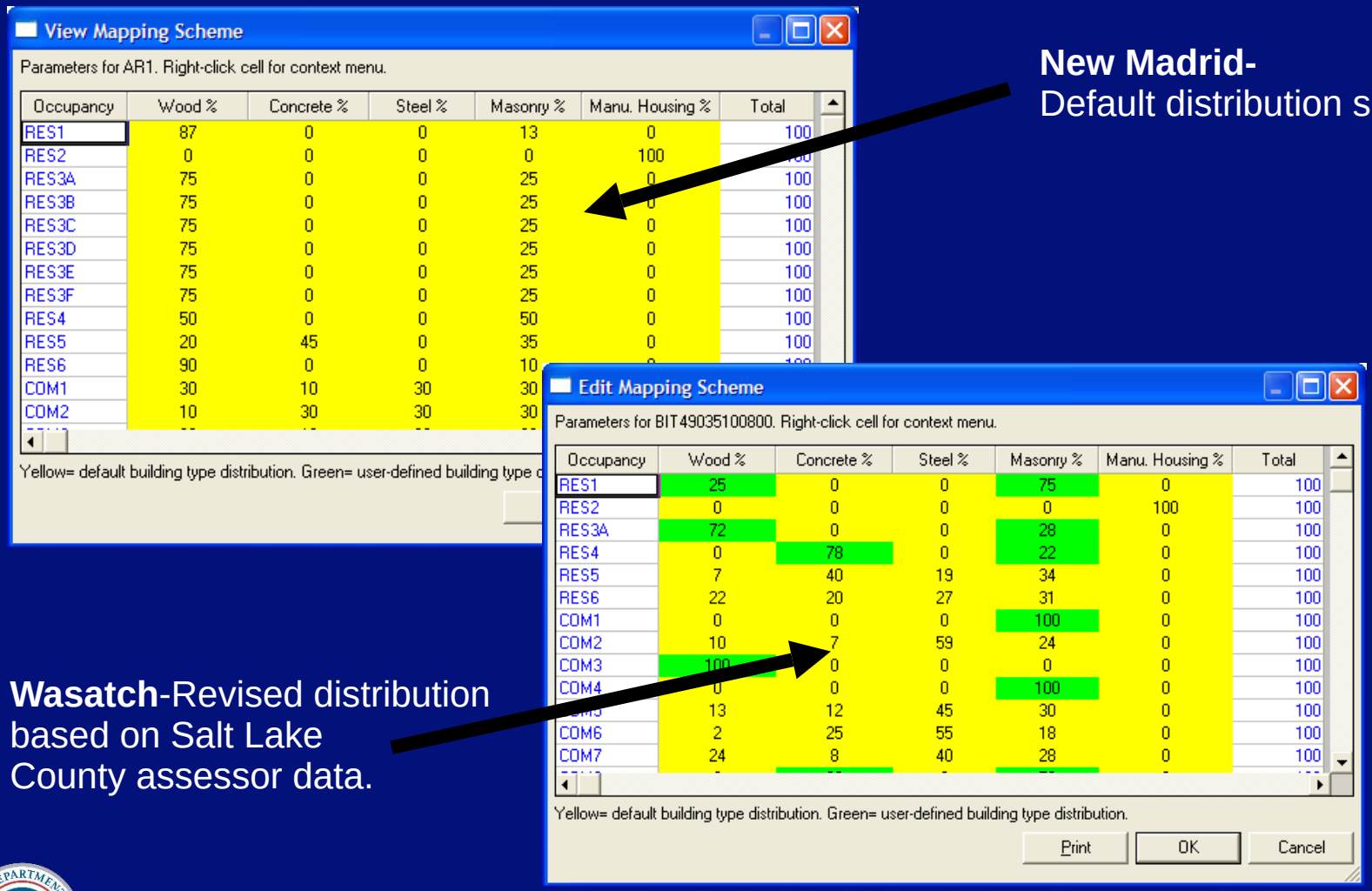
192	BIT49035110103	49035110103	1	2/7/2006 3:32:16 PM	2/7/
193	BIT49035102300	49035102300	1	2/7/2006 3:32:16 PM	2/7/
194	UT - 1930s	Based on 49035103700	0	1/23/2006 5:06:46 PM	1/24
195	UT - 1940s	Based on 49035102900	10	1/23/2006 5:08:06 PM	1/24
196	UT - 1950s	Based on 49035104000	19	1/23/2006 5:08:58 PM	1/24
197	UT - 1960s	Based on 49035110103	74	1/23/2006 5:09:43 PM	1/24
198	UT - 1970s	Based on 49035112000	58	1/23/2006 5:10:51 PM	1/24
199	UT - 1980s	Based on 49035113405	59	1/23/2006 5:11:57 PM	1/24
200	UT - 1990s	Based on 49035112815	26	1/23/2006 5:12:41 PM	1/24

Wasatch-Based on Salt Lake County assessor data, assigned to surrounding region based on median year built

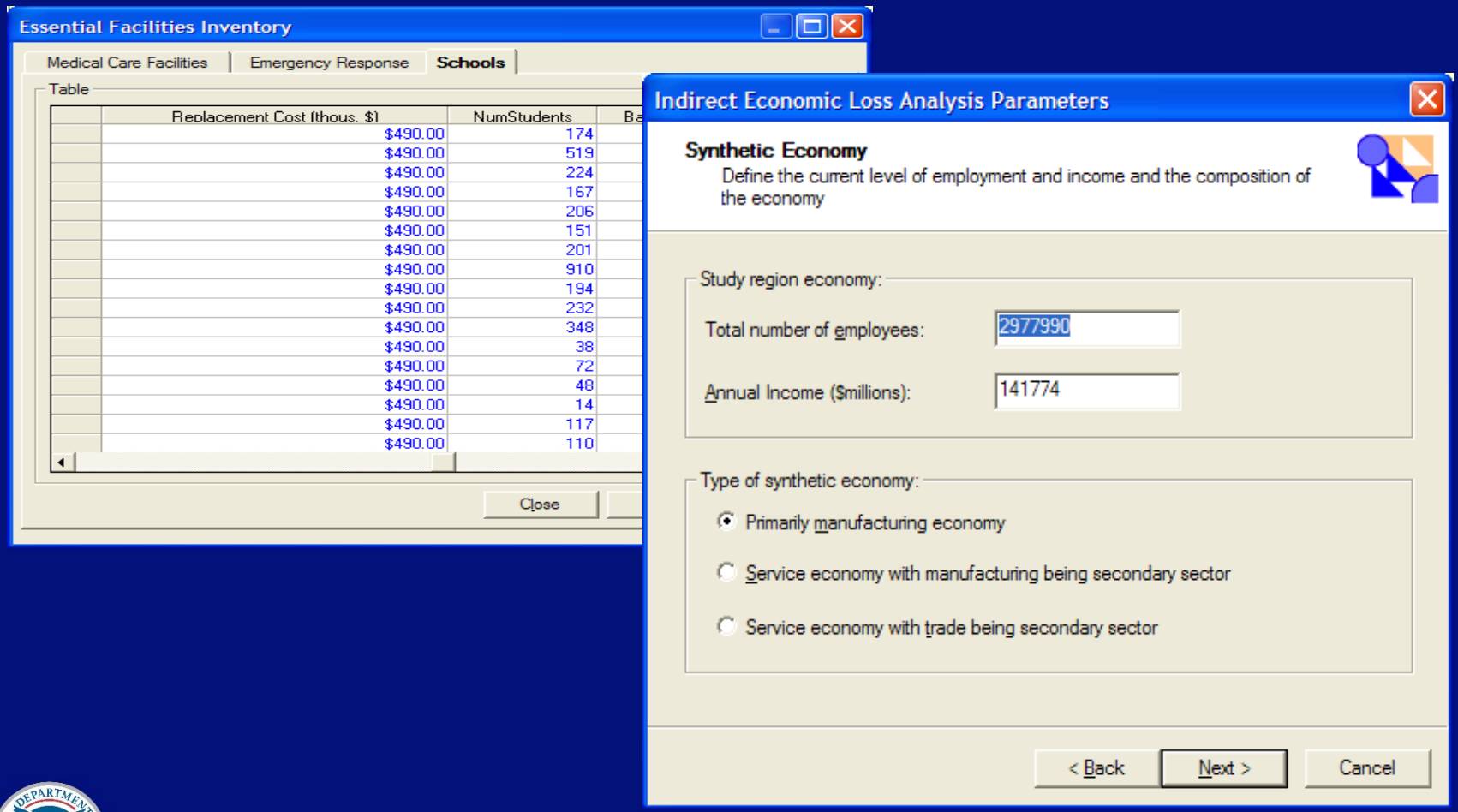
Improve Occupancy Mapping



New Madrid-
Default distribution scheme

Wasatch-Revised distribution based on Salt Lake County assessor data.

Inventory Attributes



Why Use HAZUS for NMSZ Catastrophic Planning

- ***Identify Vulnerabilities and Develop Mitigation Priorities***
- ***Avoid Duplication of Efforts***
- ***Use Resources for Inventory (GIS) and Hazard Information***
- ***Produce Updateable Scenario-Journey not a destination***
- ***Nationally Consistent Methodology***

THE END

http://www.fema.gov/plan/prevent/hazus