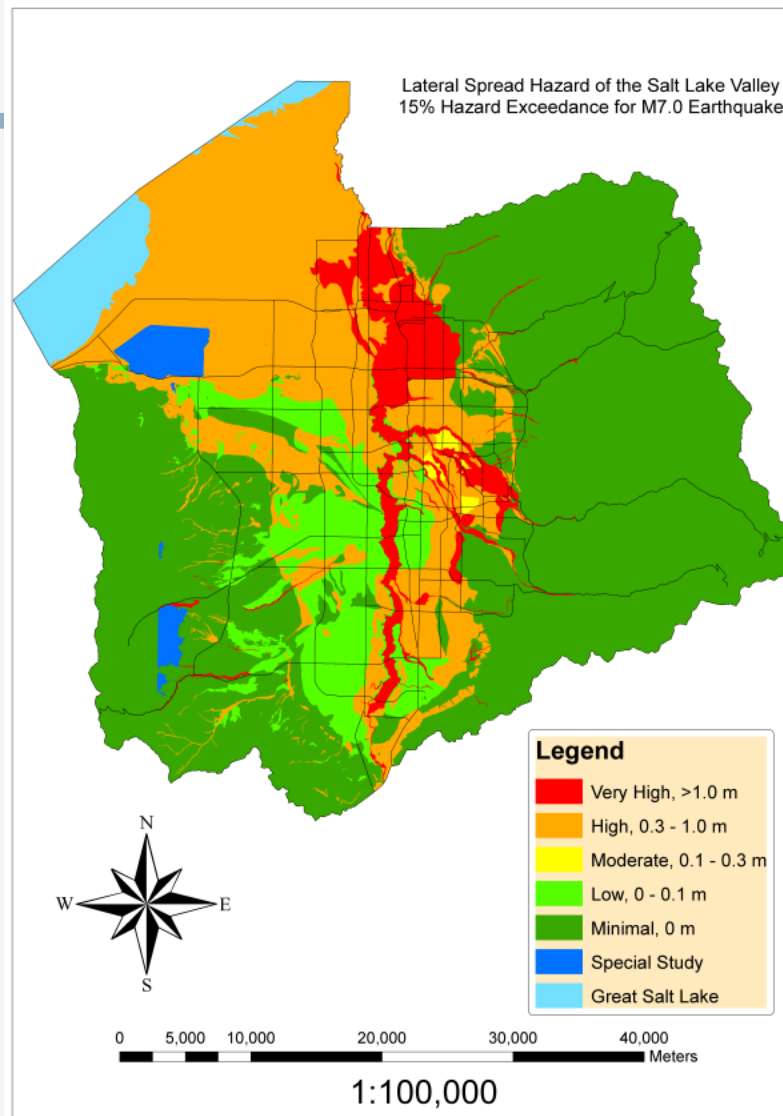


Utah Liquefaction Advisory Group (ULAG)



Progress Report on Liquefaction Working Group

February 15, 2011
Salt Lake City, Utah

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University of Utah

ULAG Members and Participants



UtahState



Members

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Jim Higbee, UDOT

Travis Gerber, URS

Bill Turner, Earthtec

Ryan Cole, Gerhart-Cole

Utah's Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 1

Develop Probabilistic Liquefaction Hazard Maps for Urban Counties in Utah

Salt Lake County

Utah County

Davis County

Weber County

Cache County

Utah's Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 1 (cont.)

Types of Maps

- (1) Liquefaction Triggering Maps
- (2) Lateral Spread Displacement Hazard Maps
- (3) Liquefaction-Induced Ground Settlement Maps

Utah's Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 2

Develop ARC GIS Programs for Implementing Probabilistic Mapping Procedures for Other Regions in U.S.

- **Strong ground motion hazard estimates from PSHA and National Strong Motion Mapping Program**
- **User methods based on ArcGIS algorithms**

Utah's Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 3

Establish and Populate a Subsurface Geotechnical Database for Public Use

- **Geotechnical Evaluations**
- **Land Use Planning**
- **Research**
- **Potential Partners**
 - **UDOT**
 - **Salt Lake County and Cities**

Utah's Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 4

Education and Public Outreach

- **User Friendly Maps**
- **Assist Counties in Implementation and Ordinances**
- **Outreach Seminars and Website**

Status Previous Work

FY 2004

- **Geotechnical Database (N. Salt Lake Co.)**
- **M7.0 lateral spread displacement hazard map (N. Salt Lake Co.) published in *Earthquake Spectra*.**

FY 2005

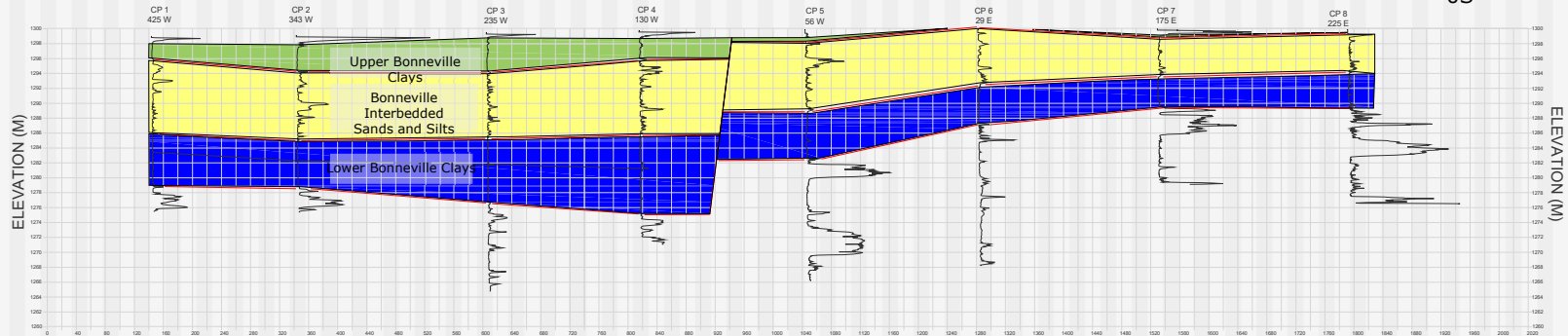
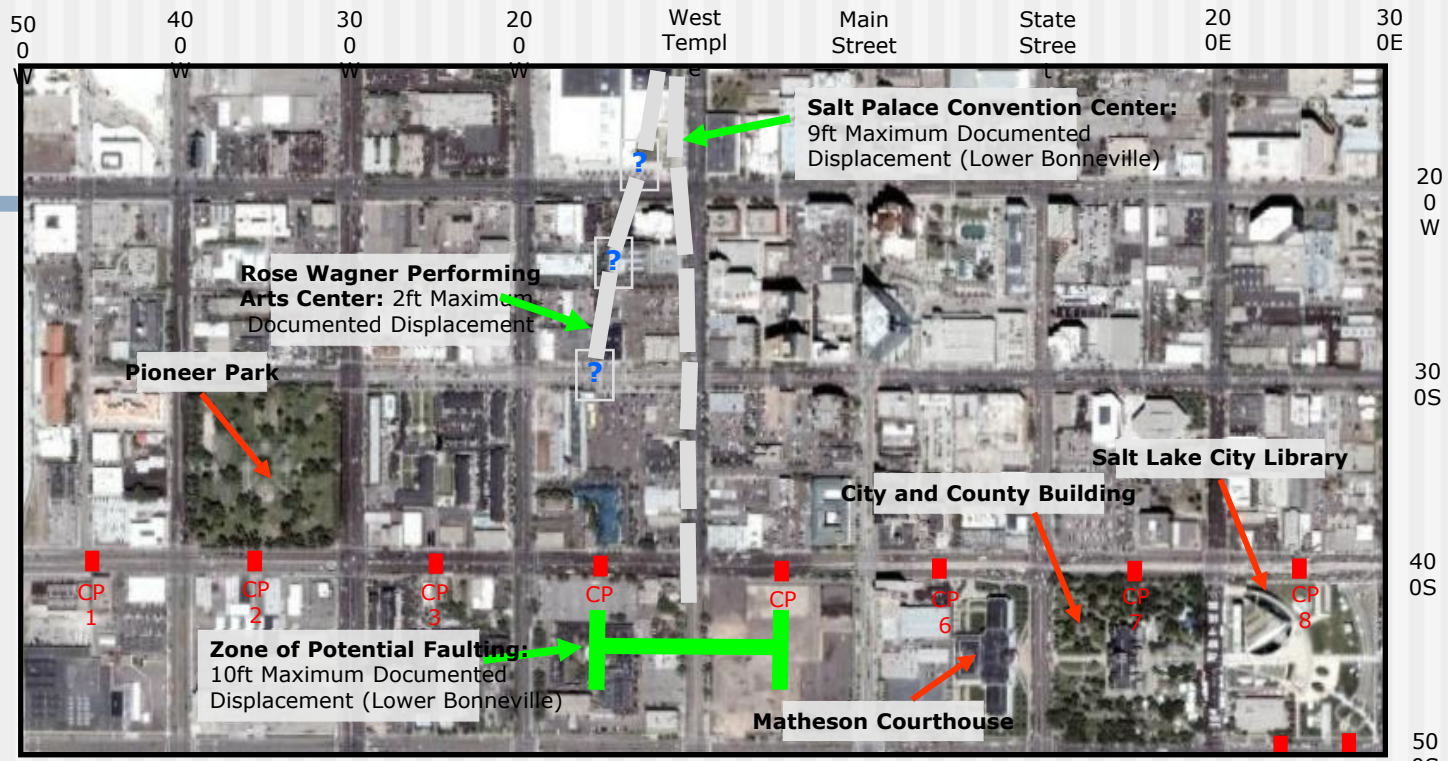
- **Geotechnical Database (S. Salt Lake Co.)**

Status Previous Work

FY 2006

2.1.1	7	
Task 1: Development of CPT and SPT correlations (University of Utah).....	7	2.1.1 Done
2.1.2 Task 2: Correlation of Subsurface Geologic and Geotechnical ArcGIS™ Database with Surficial Geologic Mapping (Utah Geological Survey)	8	2.1.2 Done
2.1.3 Task 3: Mapped mean annual probability of triggering liquefaction for southern Salt Lake County (University of Utah)	8	2.1.3 Done
2.1.4 Task 4: Mapped probability of triggering liquefaction for a scenario earthquake for Salt Lake County (University of Utah)	8	2.1.4 Done
2.1.5 Task 5: Mapped mean annual probability of lateral spread exceeding displacement thresholds of 0.1, 0.3 and 1.0 meters for northern Salt Lake County (University of Utah).....	9	2.1.5 Done
2.1.6 Task 6: Mapped lateral spread horizontal displacement for a scenario event for northern Salt Lake County (University of Utah)	9	2.1.6 Done
2.1.7 Task 7: Synthesis report of seismically induced ground displacement in Salt Lake County (University of Utah, Simon-Bymaster, Inc., and Utah Geological Survey)	9	2.1.7 Done
2.1.8 Task 8: CPT subsurface investigations in downtown Salt Lake City (University of Utah and ConeTech)	12	2.1.8 Done
2.1.9 Task 9: Map production and report delivery (University of Utah and Utah Geological Survey).....	12	2.1.9 Done

Downtown Displacement Investigations



Possible Extension of the Warm
 Approximate Fault
 ■ Approximate CPT Sounding Locations

Status Previous Work

FY 2007

2.1 Methods and Tasks – Phase IV, FY 2007	8	
2.1.1 Task 1: Collection and preliminary geologic analysis of surface and subsurface data to identify data gaps and data-collection requirements for future hazard mapping efforts in Utah Valley (Brigham Young University, University of Utah, Utah Geological Society).....	9	2.1.1 Done
2.1.2 Task 2: Completion of probabilistic lateral spread hazard maps and deterministic lateral spread hazard map for a scenario earthquake for southern Salt Lake County (University of Utah).....	10	2.1.2 Done
2.1.3 Task 3: Development of liquefaction-induced settlement map for Salt Lake County (Brigham Young University, University of Utah).	10	2.1.3 Done
2.1.4 Task 4: Map production and report delivery (University of Utah, Brigham Young University and Utah Geological Survey).....	10	2.1.4 Done

FY 2008 (No Funding)

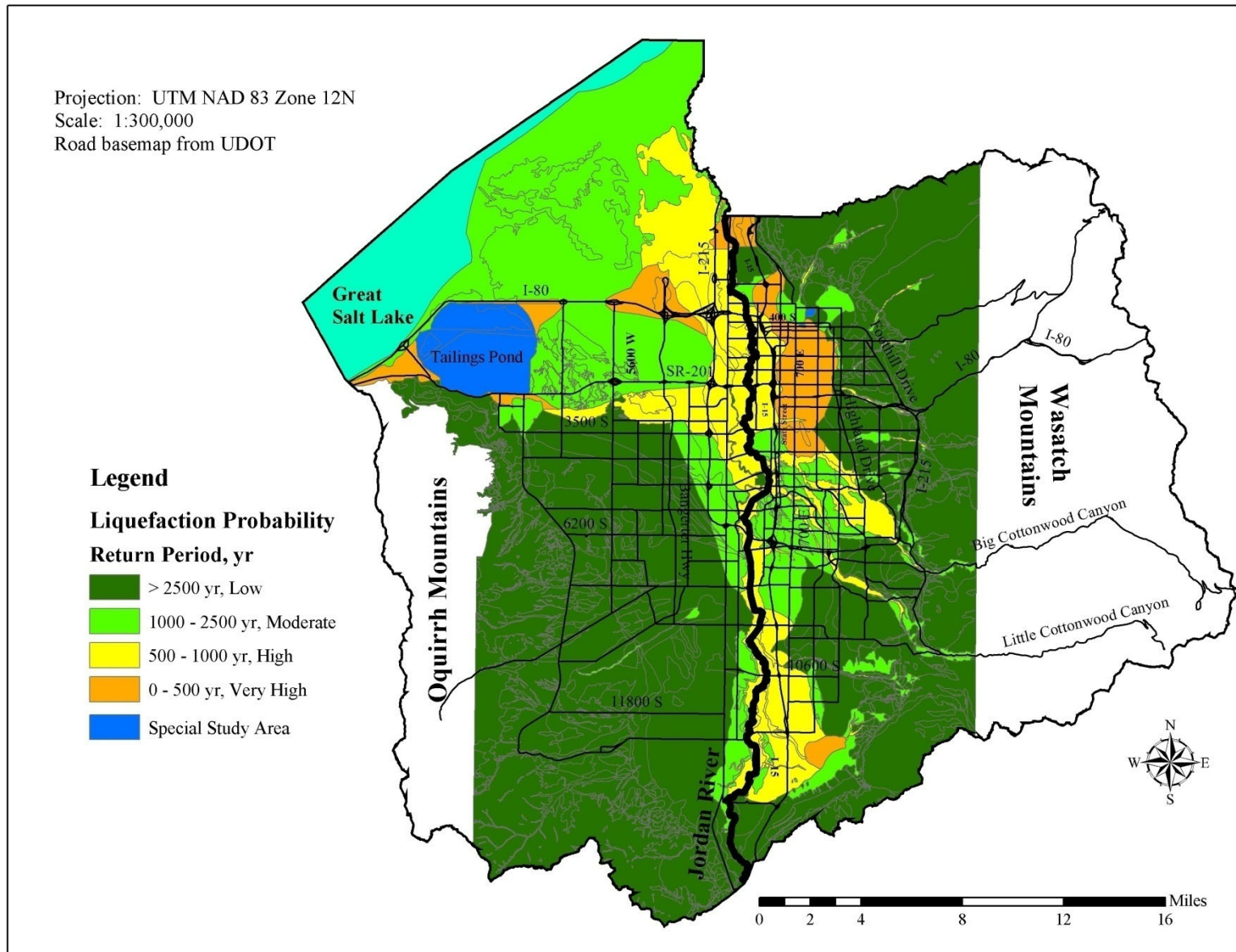
FY 2009 (No Funding)

FY 2010 (No Funding)

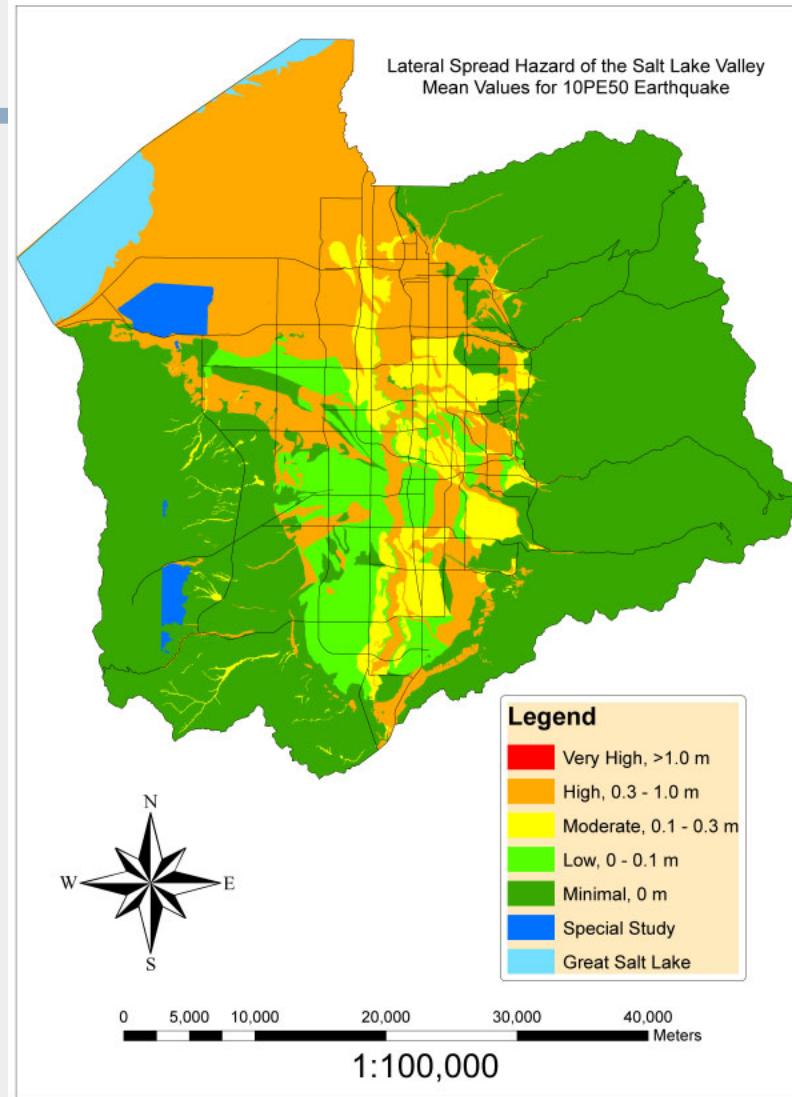
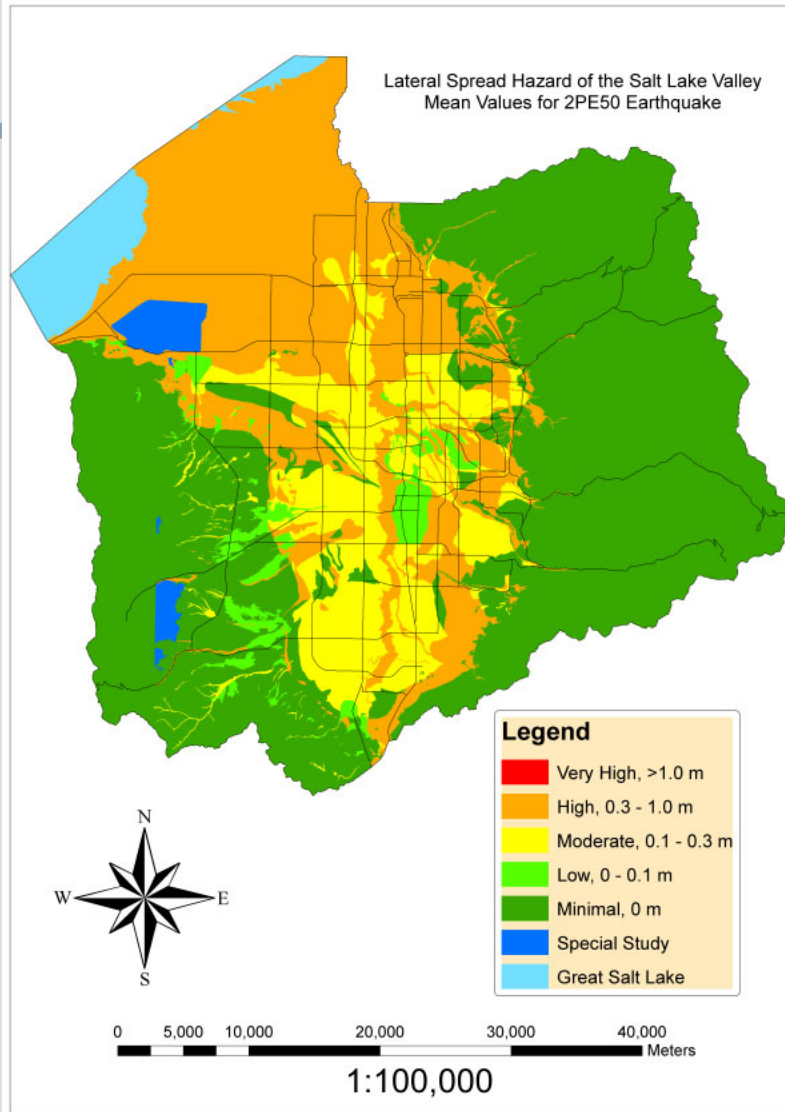
**FY 2010 (Partial Funding from
WBWCD)**

FY 2011 (UGS –Funding)

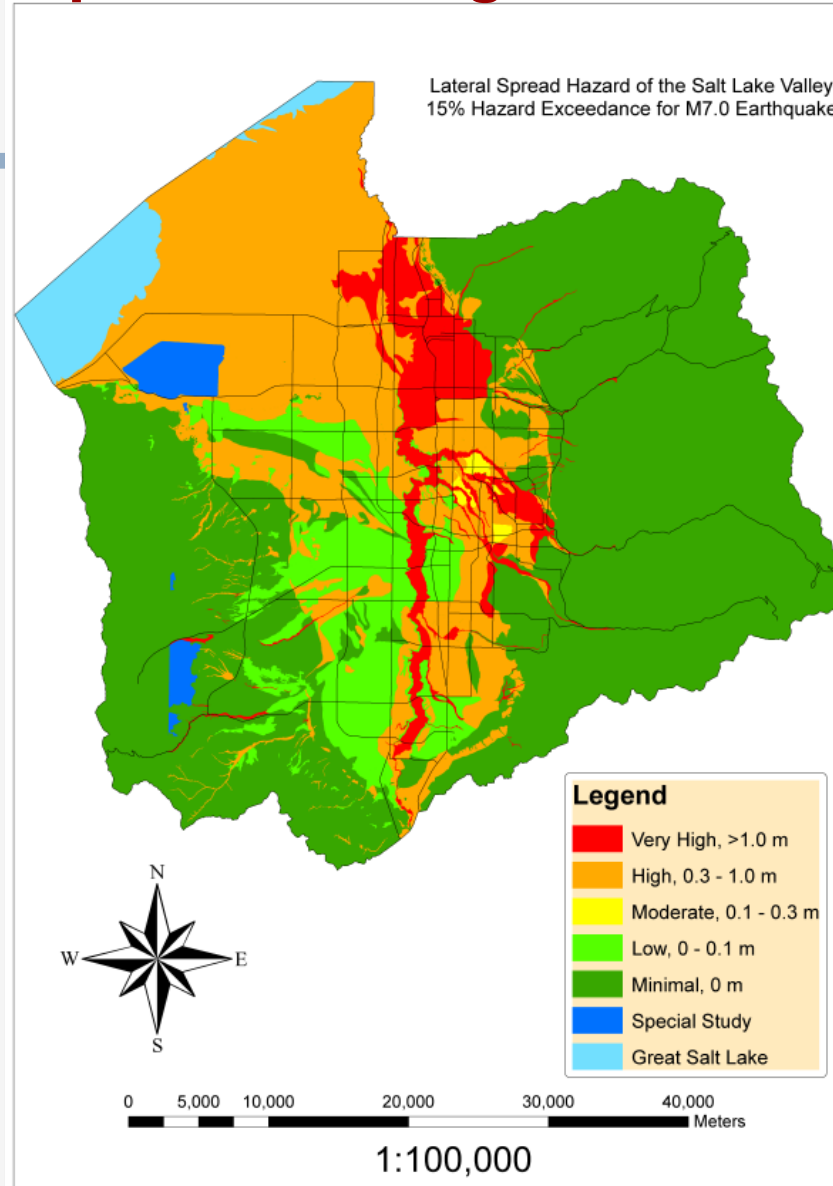
Probabilistic liquefaction potential map – (2002 Input)



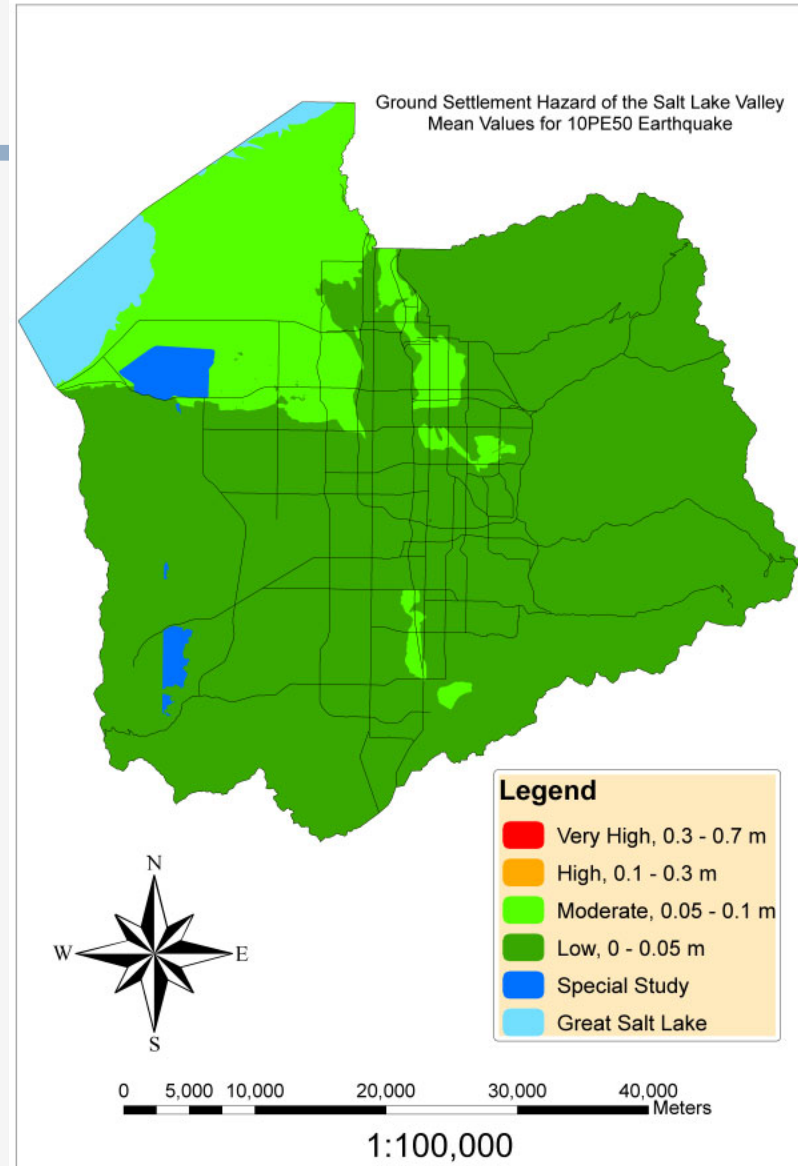
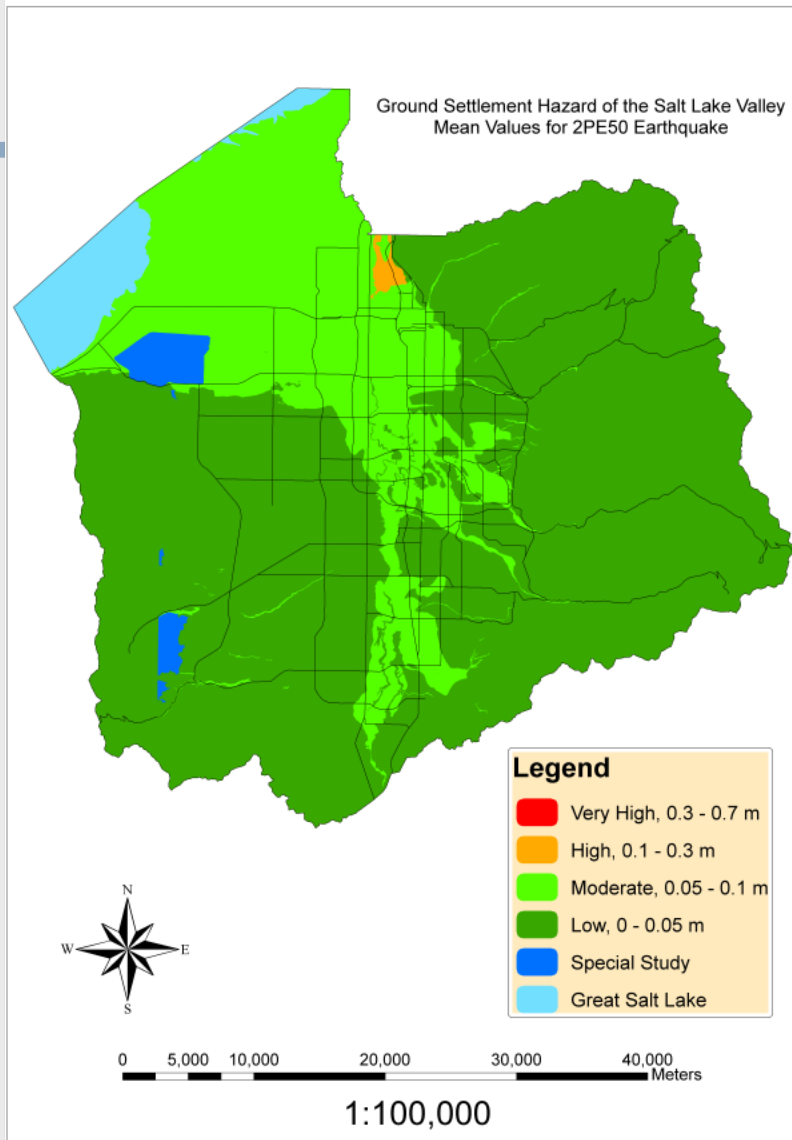
Probabilistic liquefaction potential maps for 2500 and 500-year return periods



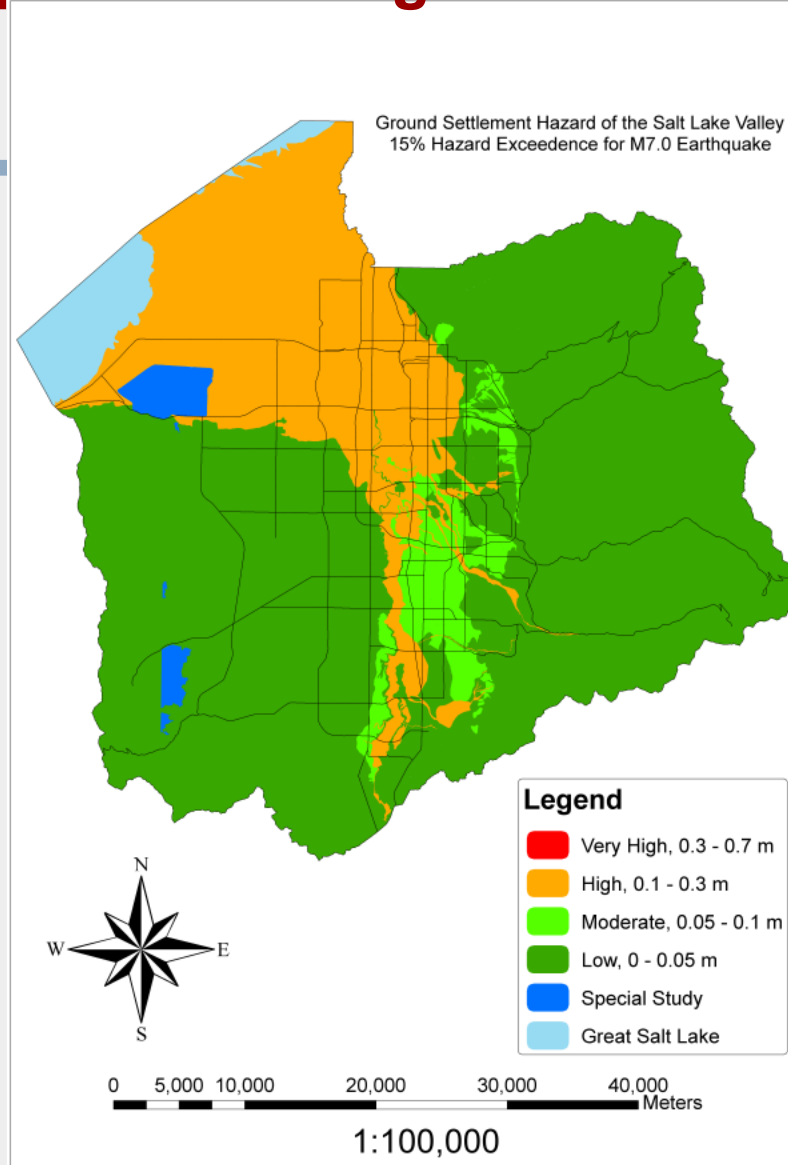
M 7.0 Lateral spread displacement map 15 percent change of exceedance



Probabilistic ground settlement maps for 2500 and 500-year return periods



M 7.0 ground settlement map 15 percent change of exceedance



Weber County Liquefaction Hazard Mapping

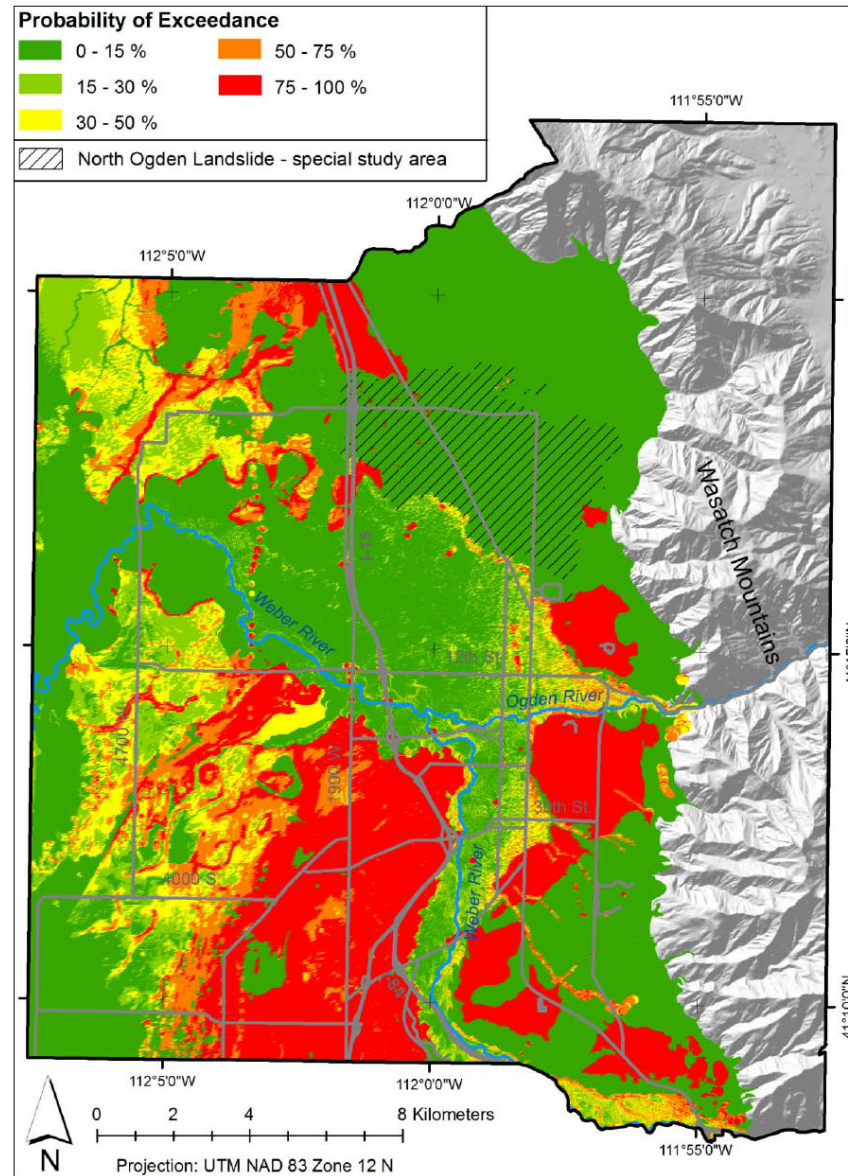


Figure 5.12. 50th percentile probabilities of lateral spread displacement exceeding 0.3 meters for a 2,500-year seismic event; Weber County, Utah

FEMA Project (U of U and UGS)

1. Develop a new model ordinance for liquefaction hazards based on input and feedback from municipalities, technical advisory groups, and others.
2. Educate various municipalities and their stake holders regarding risk-based decision making and hazard mitigation using the newly developed hazard ordinance that is coupled with the recently developed ULAG liquefaction hazard maps and support and encourage the implementation/adoption of the new liquefaction hazard ordinance in the various municipalities along the urban Wasatch Front.
3. Develop methods to apply the liquefaction hazard maps to assess post-event traffic interruptions resulting from liquefaction-induced damage
4. Educate the next generation of Utahans about earthquake hazards by focusing on a secondary education outreach curriculum and program delivered to Salt Lake and Weber Counties.