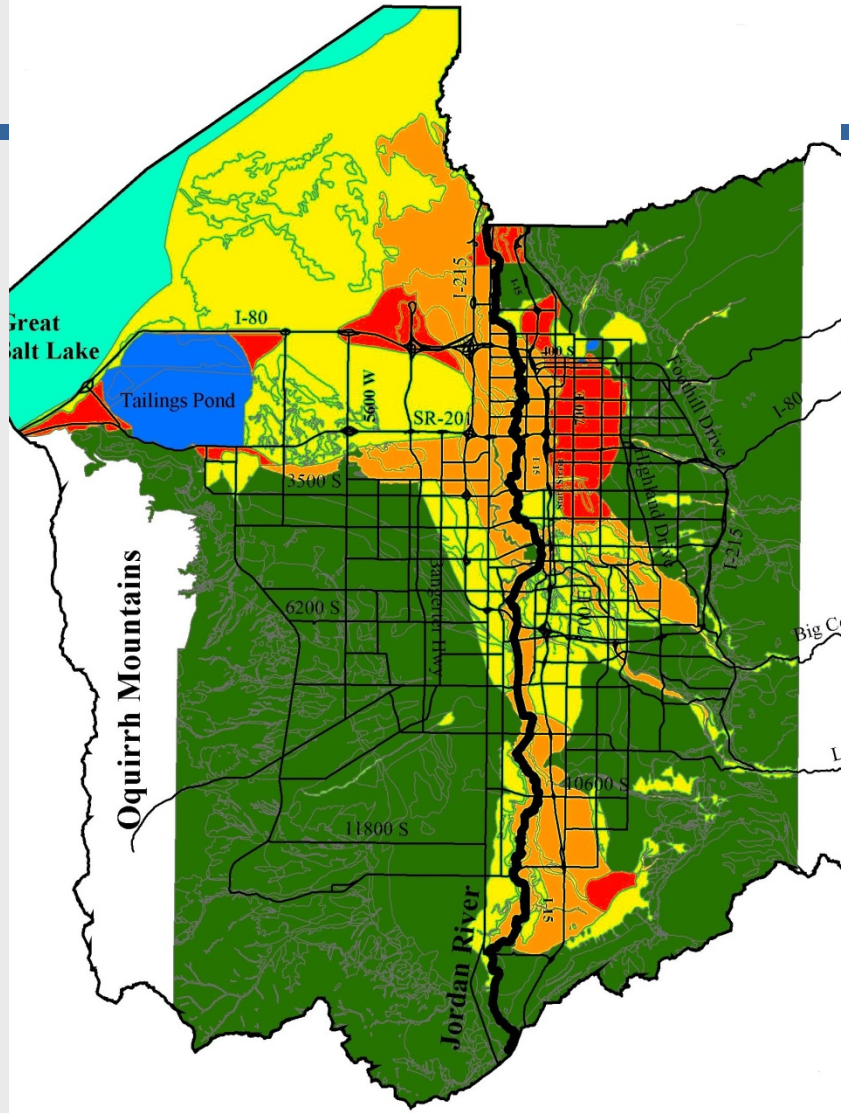
Utah Liquefaction Advisory Group (ULAG)



Progress Report on Liquefaction Working Group

February 11, 2009
Salt Lake City, Utah

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Assistant Professor
University of Utah

ULAG Members and Participants

Members

Steve Bartlett, UU CE, Facilitator

Mike Hylland, UGS liaison

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Grant Gummow, UDOT

Aurelian Trandafir, UUGG

Jim Higbee, UDOT

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
2.1.2 Task 2: Correlation of Subsurface Geologic and Geotechnical ArcGIS™ Database with Surficial Geologic Mapping (Utah Geological Survey) 8
2.1.3 Task 3: Mapped mean annual probability of triggering liquefaction for southern Salt Lake County (University of Utah) 8
2.1.4 Task 4: Mapped probability of triggering liquefaction for a scenario earthquake for Salt Lake County (University of Utah) 8
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
2.1.6 Task 6: Mapped lateral spread horizontal displacement for a scenario event for northern Salt Lake County (University of Utah) 9
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
2.1.8 Task 8: CPT subsurface investigations in downtown Salt Lake City (University of Utah and ConeTech) 12
2.1.9 Task 9: Map production and report delivery (University of Utah and Utah Geological Survey) .. 12

2.1.1 Done

2.1.2 Done

2.1.3 Done

2.1.4 Done

2.1.5 On Hold

2.1.6 Done

2.1.7 Done

2.1.8 Done

2.1.9 On Hold

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
2.1.2 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
2.1.3 Task 3: Development of liquefaction-induced settlement map for Salt Lake County (Brigham Young University, University of Utah). 10
2.1.4 Task 4: Map production and report delivery (University of Utah, Brigham Young University and Utah Geological Survey). 10

2.1.1 Unfunded

2.1.2 Hold

Done

2.1.3 Ongoing

2.1.4 Ongoing

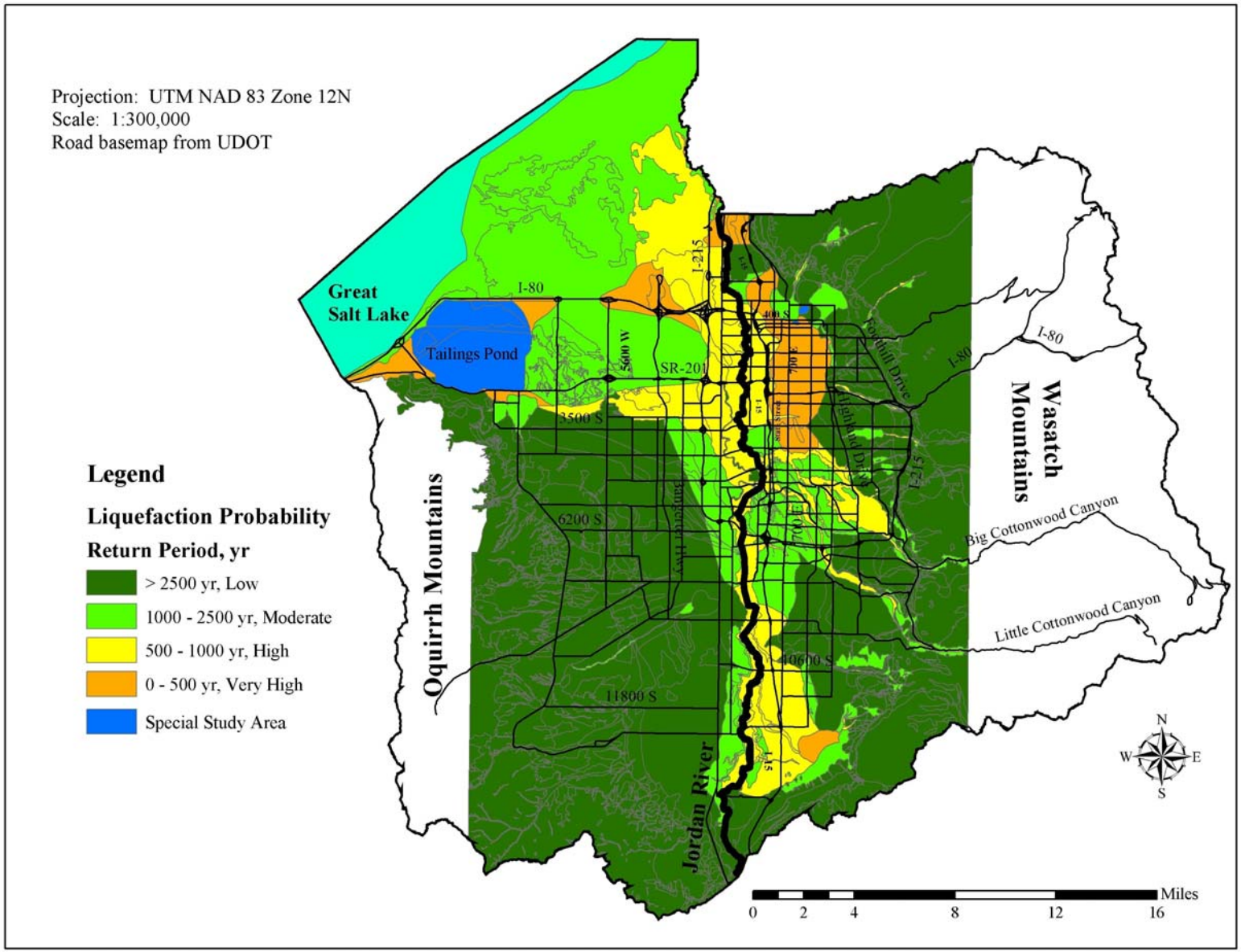
FY 2008 (No Funding)

FY 2009 (No Funding)

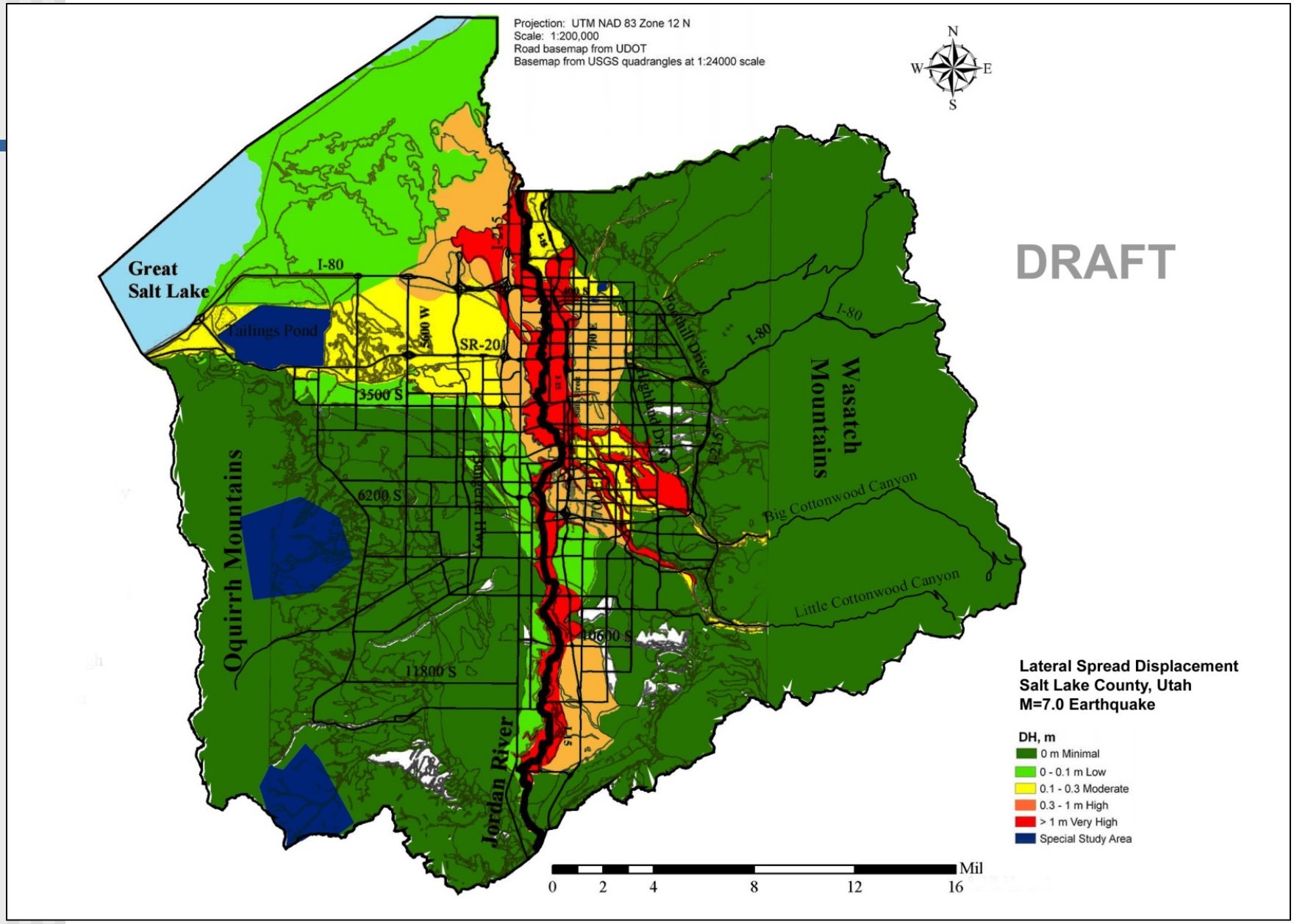
Other Items

- **Continued work on developing techniques for under-sampled units and uncertainty analysis**
  - Funded by U of U COE - $20 k
- **Performance Based GeoHazards Ordinance**
  - Draper City
  - EERI Presentation
- **Seismic Assessment of Salt Lake Valley Transportation Network (UDOT)**
  - Geotechnical database used for liquefaction evaluations
  - NEHRP site class map

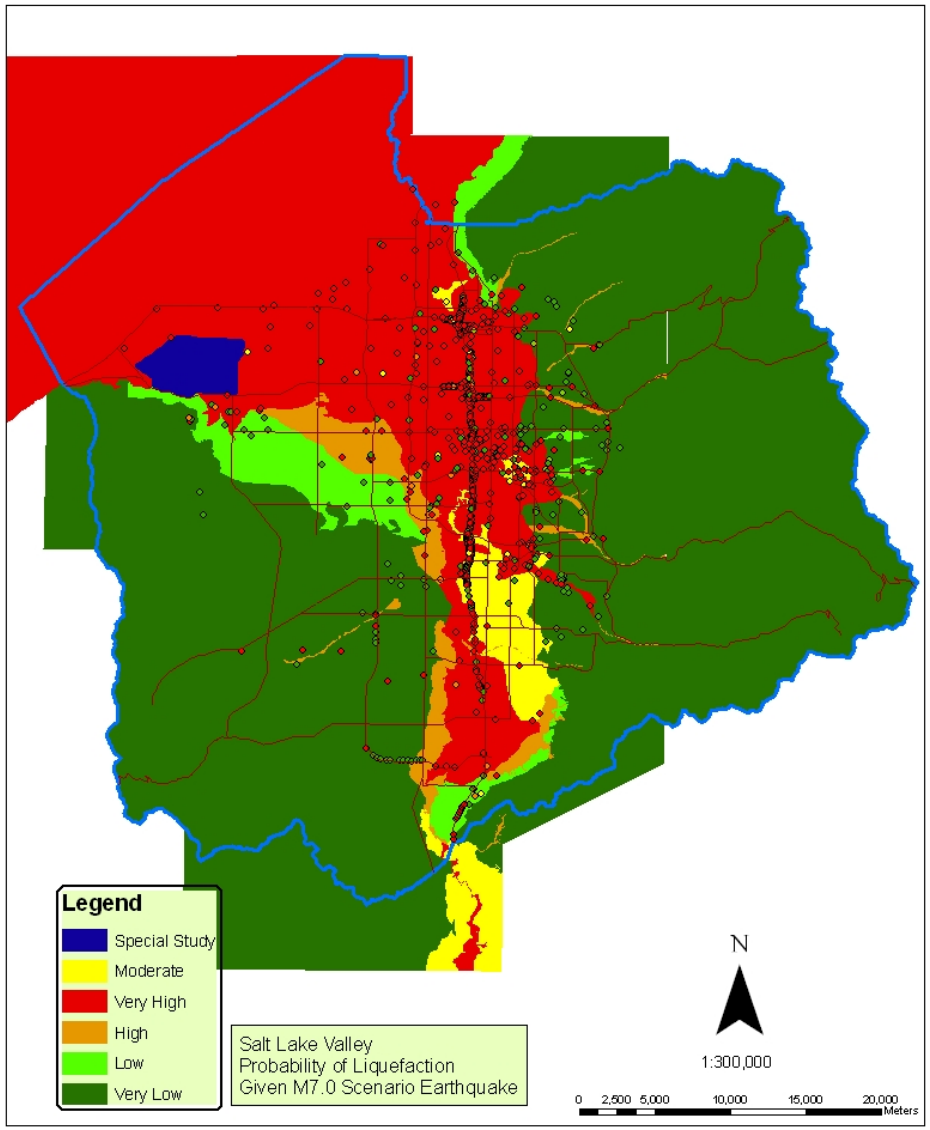
Probabilistic liquefaction potential map – (2002 Input)



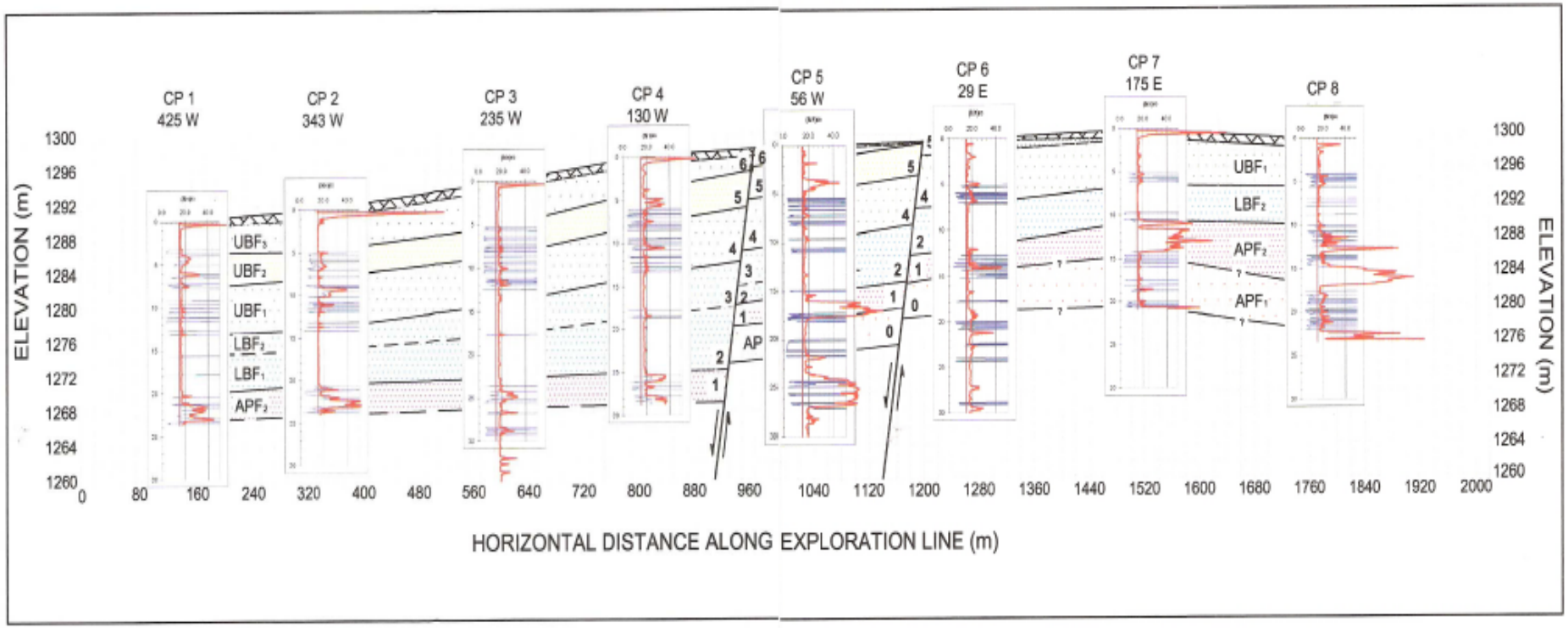
M 7.0 Lateral spread displacement map



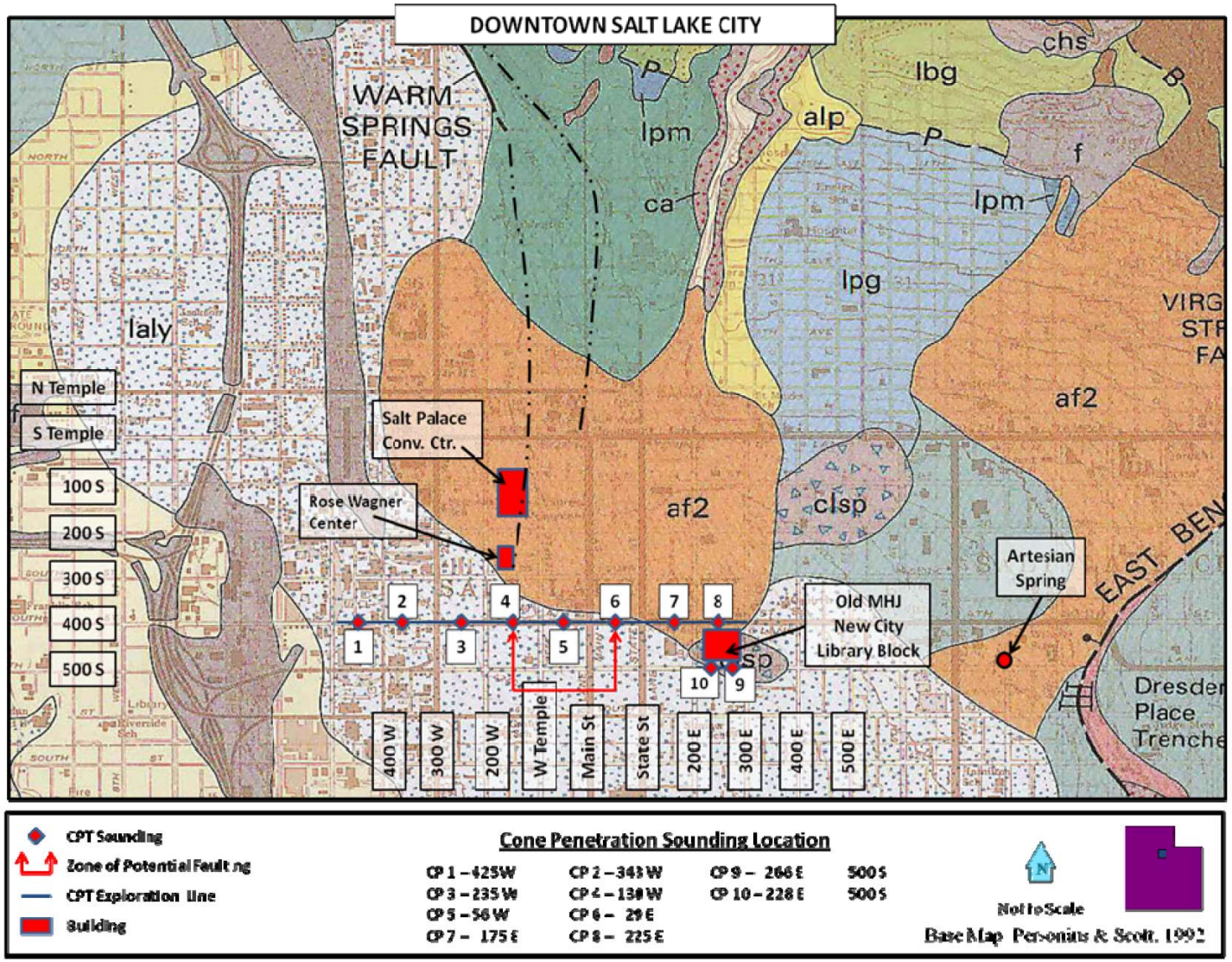
M 7.0 Probabilistic liquefaction potential map



Downtown Ground Failure Investigations



Downtown Ground Failure Investigations



2009 Work Plan

2.1 Methods and Tasks – Phase V, FY 2009 7
2.1.1 Task 1: Development of new techniques for mapping liquefaction hazard of under-sampled geologic units and quantifying the uncertainty associated with the liquefaction hazard and ground displacement estimates (University of Utah and Brigham Young University). 8
2.1.2 Task 2: Collect and analyze subsurface data for hazard mapping in Utah and Davis Counties (Brigham Young University and Utah Geological Survey) 9
2.1.3 Task 3 Conduct additional CPT investigations to resolve origin of potential fault versus lateral spread offsets in downtown Salt Lake City (University of Utah) 9
2.1.4 Task 4 Develop a performance-based method to help end user select appropriate return period for building and land use of the maps (University of Utah and Brigham Young University) 10
2.1.5 Task 5 Develop techniques for analyzing the Farmington Siding landslide complex in Davis County (University of Utah, Brigham Young University, Utah Geological Survey) 10

Feedback from Review Panel

Strengths

- PIs are highly qualified
- Acknowledged that continued liquefaction assessments are important to the Wasatch Front

Weaknesses

- Comparison of new and earlier maps
- Questioned how long should NIW panel fund this work?
- Budget high and not commensurate with expected results
- Task 5 appears “tacked on”
- State and local match would increase chance of funding