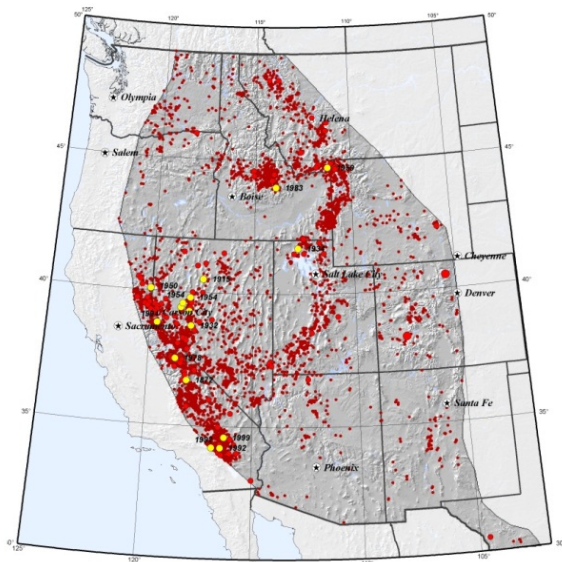


InterMountain West Regional Update

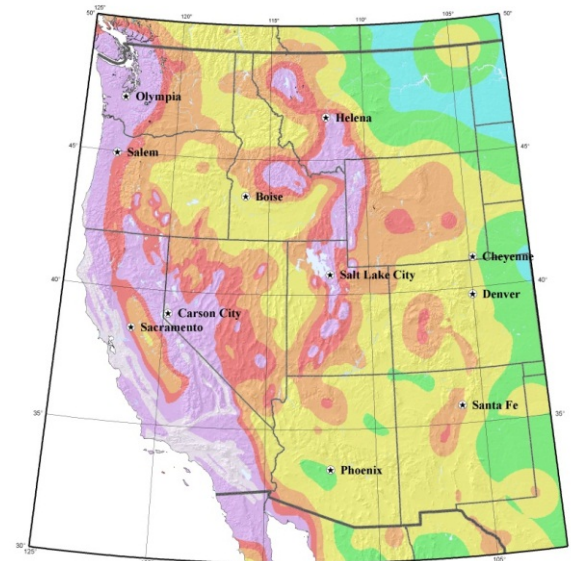
National Seismic Hazard Map IMW Workshop
13-14 June 2012

Anthony J. Crone

InterMountain West Region



IMW Historical Seismicity



Western US Hazard Map

- Includes all or part of 12 states
- Spans several distinct geological provinces
- Largely dominated by extensional deformation
- Focus on highest short-term hazard:
 - Wasatch Front
 - Eastern margin of Sierra Nevada

USGS Earthquake Hazards Program

National Earthquake Hazards Reduction Program
(NEHRP) (Established 1977)

National Science
Foundation
(NSF)

U.S. Geological
Survey
(USGS)

Federal Emergency
Mgmt. Agency
(FEMA)

National Institute
Standards & Tech.
(NIST)

USGS
Earthquake Hazards Program
(EHP)

Internal USGS Projects
(IMW project)
(NSHM project)

EHP External Grants Program
(Non-USGS PIs)
(Elizabeth Lemersal: manager)

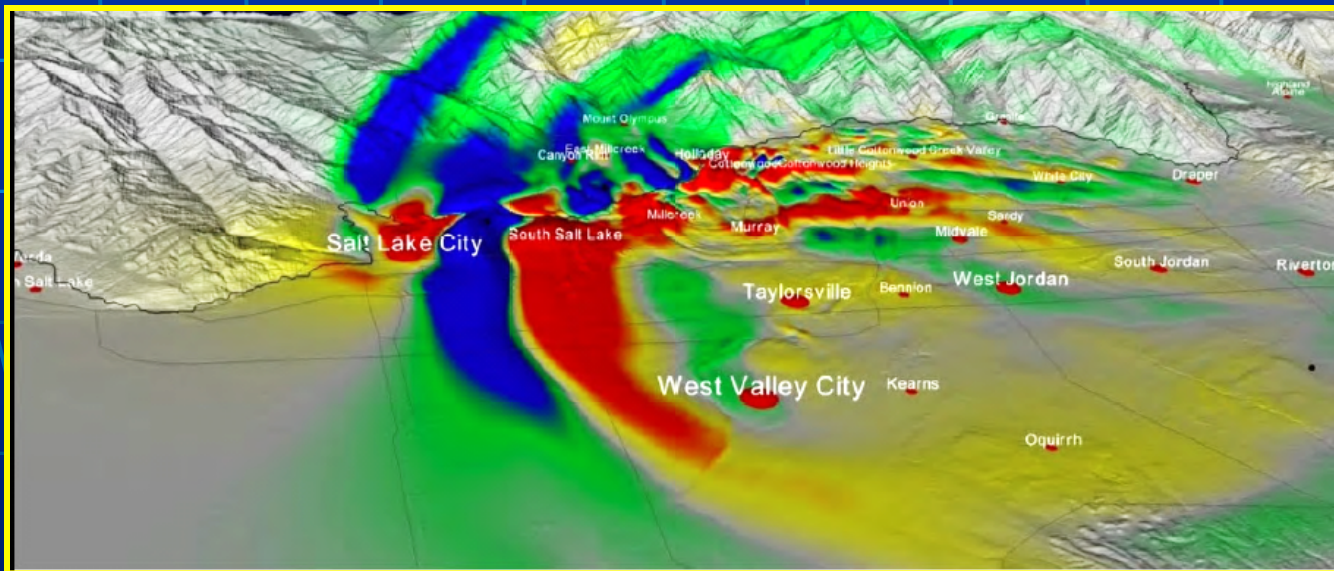
EHP Regional Coordinators
A.J. Crone: IMW region
M.D. Petersen: National region

IMW Research Activities and Goals

Wasatch Front, Utah

Focus on: **Development of Urban Hazard Maps**
Wasatch Front time-dependent probability assessment

- a.) **Community Velocity Model (CVM) for Salt Lake Valley (SLV).**
CVM: unified subsurface velocity model needed to simulate ground motions in SLV.
- b.) **Simulations include effects of different source locations, basin velocity structure, and amplification effects. Elements of models include: soil classes, basin geometry, basin-sediment interfaces, crustal tomography, and Moho effects.**



IMW Research Activities and Goals

Wasatch Front, Utah

New paleoseismic data on the five central segments of the Wasatch fault zone (WFZ) since 2002.

Northern Wasatch Sites:

Brigham City segment:

Hansen Canyon

Kotter Canyon

Pearsons Canyon (north)

Weber Segment:

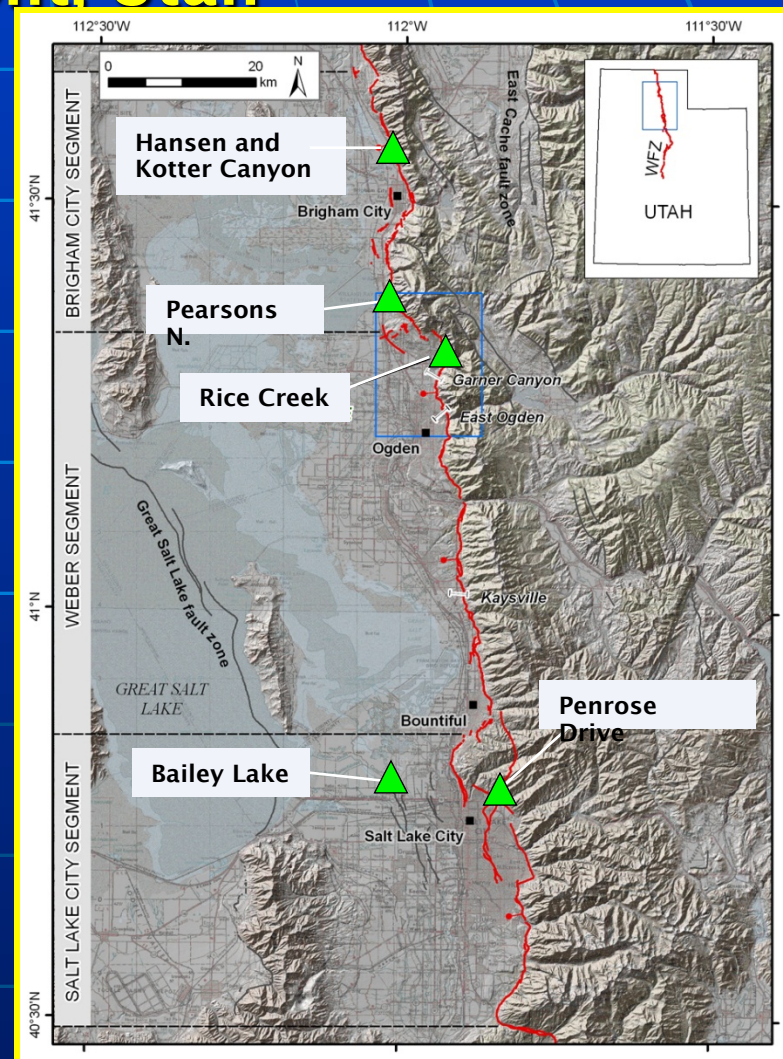
Rice Creek

Salt Lake City segment:

Penrose Drive site (East Bench

fault)

Baileys Lake site
(West Valley fault zone)



IMW Research Activities and Goals

Wasatch Front, Utah

New paleoseismic data on the five central segments of the Wasatch fault zone (WFZ) since 2002.

Southern Wasatch Sites:

Provo segment:

Mapleton mega-trench

Nephi Segment:

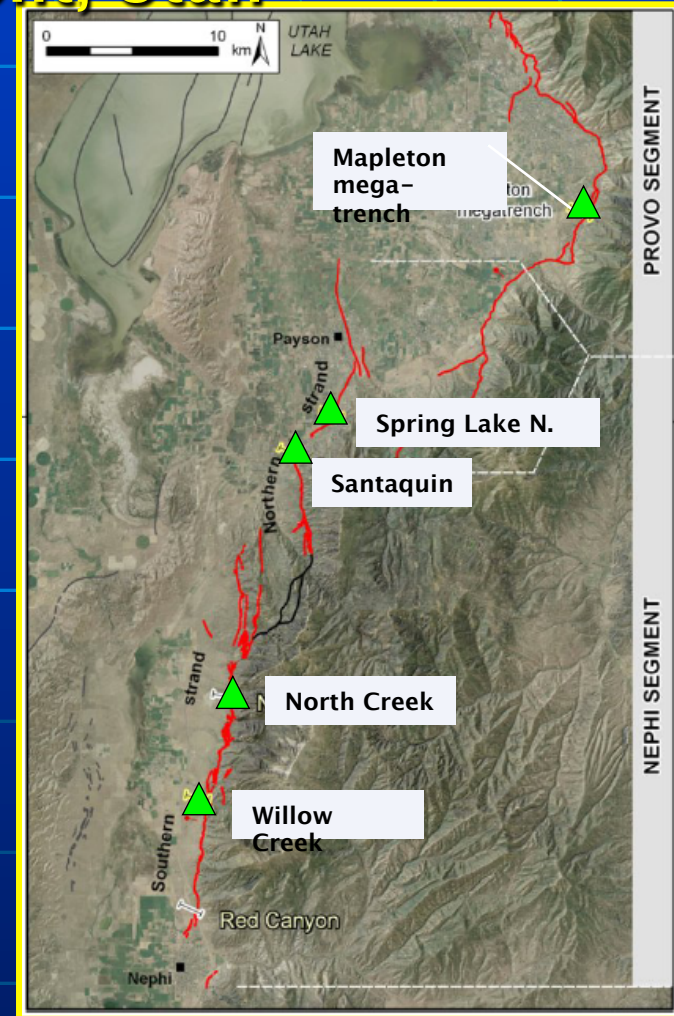
Spring Lake North site*

Santaquin site

North Creek site*

Willow Creek site

* Studies in progress



IMW Research Activities and Goals

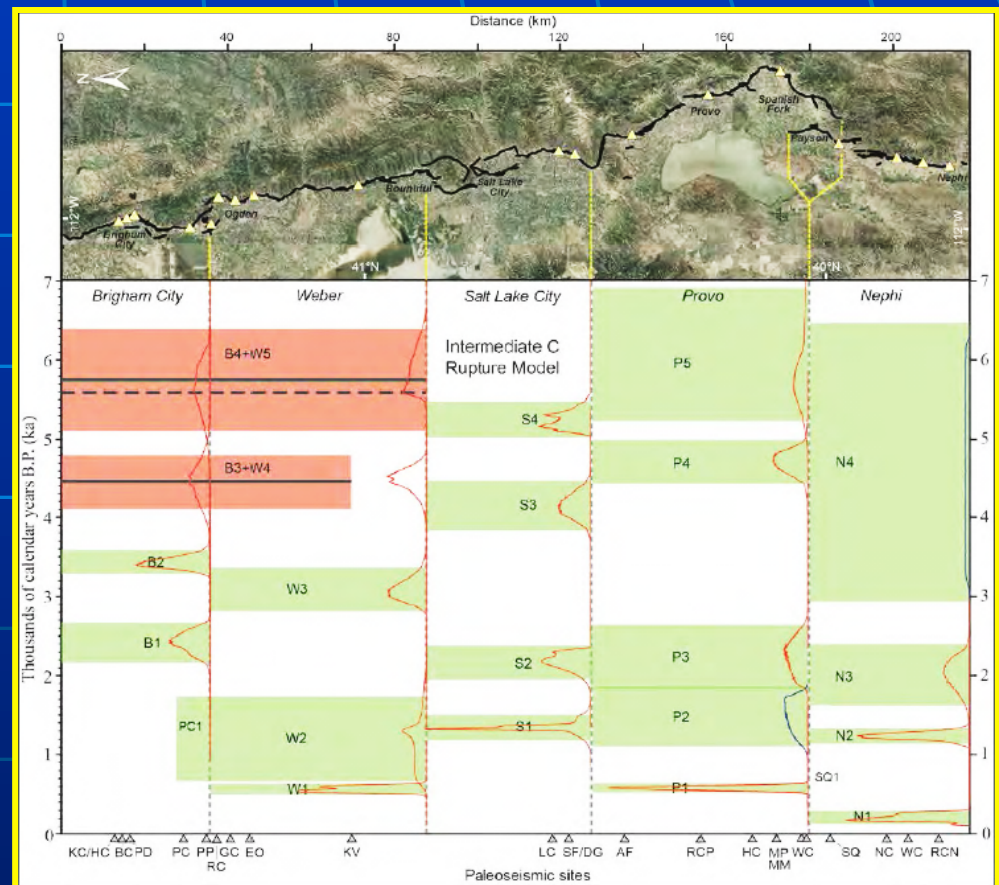
Wasatch Front, Utah

Wasatch fault zone rupture model

New and legacy paleoseismic data led to:

- a.) refined earthquake chronologies
- b.) new models of rupture sequences and scenarios
- c.) updated geological slip-rate and recurrence estimates

Much of the data from the Urban Hazard mapping and the Earthquake Probability efforts also contribute to updates of National Seismic Hazard maps.



IMW Research Activities and Goals

Reno–Carson City Corridor, Nevada



Longer-term IMW goal: develop Urban Hazard maps for Reno–Carson City (RCC) urban corridor.

Initial stages of collecting and organizing data needed to develop CVM.

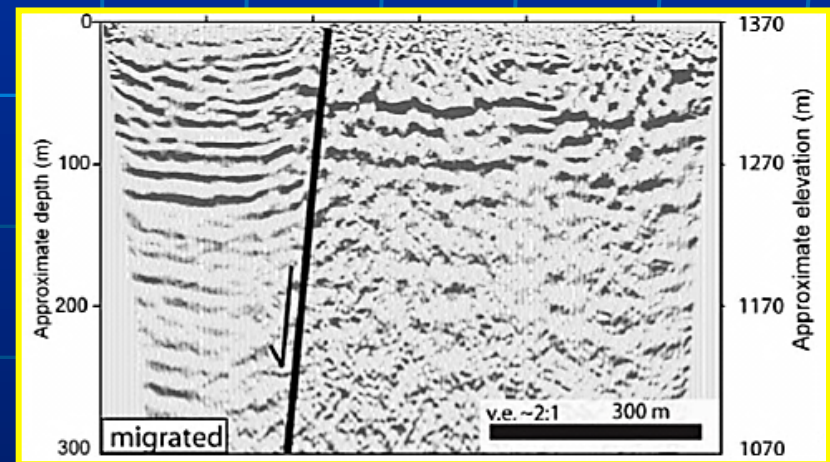
IMW Research Activities and Goals

Reno–Carson City Corridor, Nevada

Challenges:

- Information on seismic sources (faults) poorly known.
- Shallow, high-resolution reflection data in urban Reno has identified previously unrecognized faults beneath city.
- Style and complexity of deformation more difficult to decipher compared to the Wasatch Front.

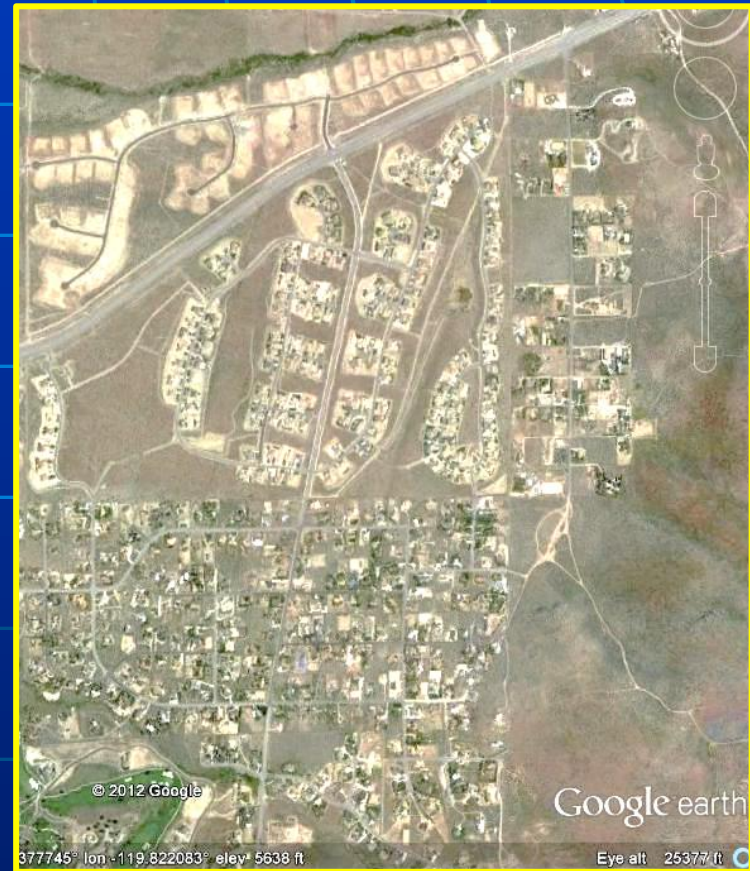
Reflection profile along Truckee River bike path, Reno



IMW Research Activities and Goals

Reno area fault investigations

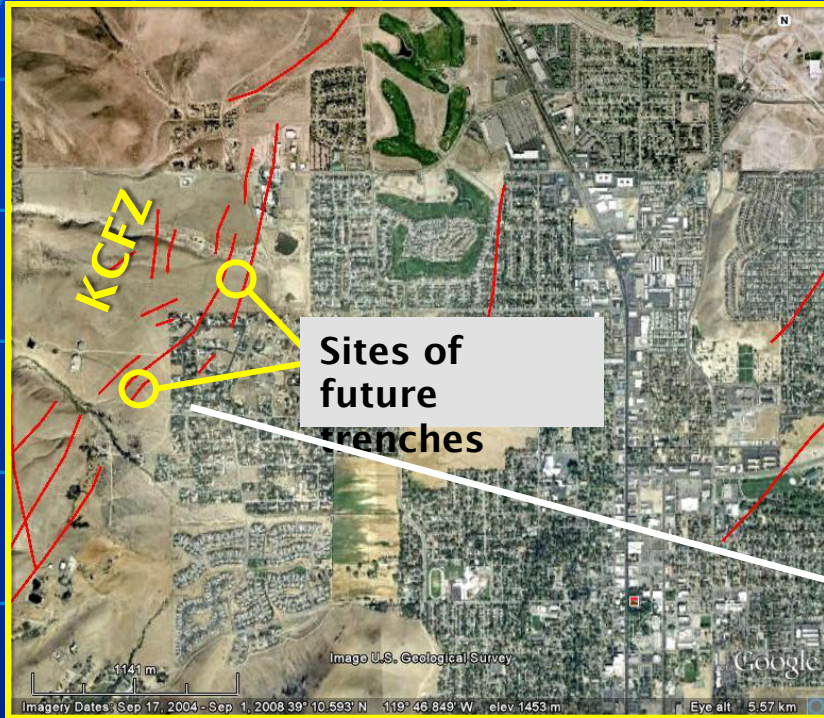
Mt. Rose piedmont fault zone, South Reno



Low sun-angle Image courtesy of D.B. Slemmons

IMW Research Activities and Goals

Carson City fault investigations

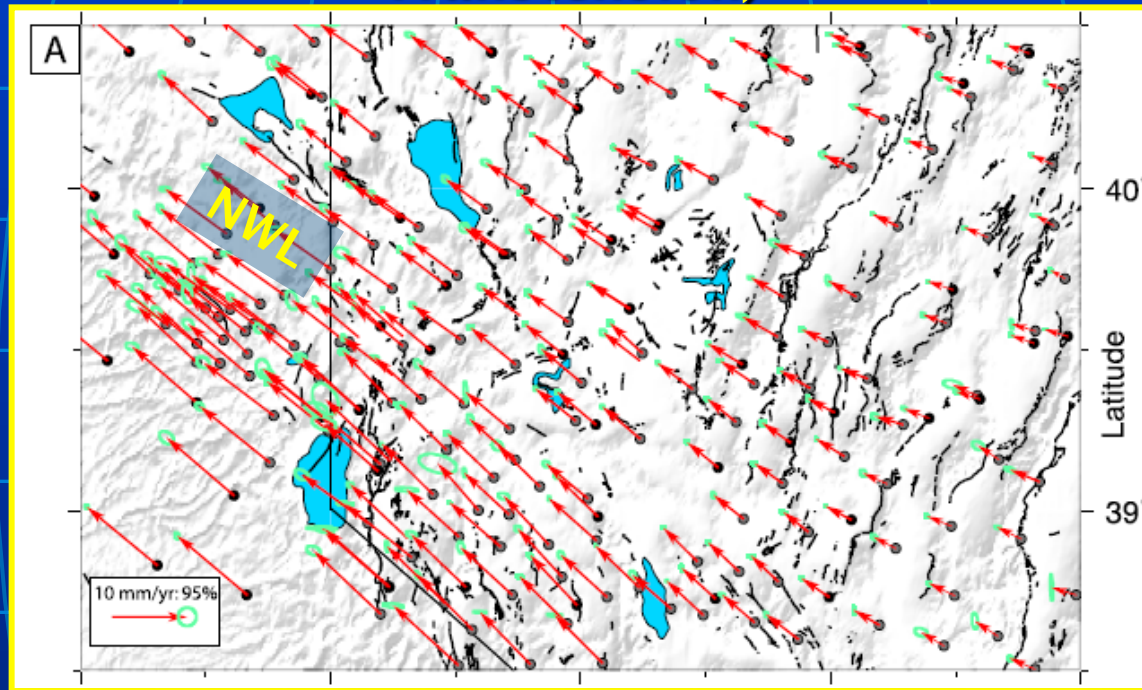


Kings Canyon fault zone, Carson City



View to SW, Joost Ranch scarp, Kings Canyon fault zone

Nevada Geodesy (MAGNET--Mobile Array of GPS for Nevada Transtension)

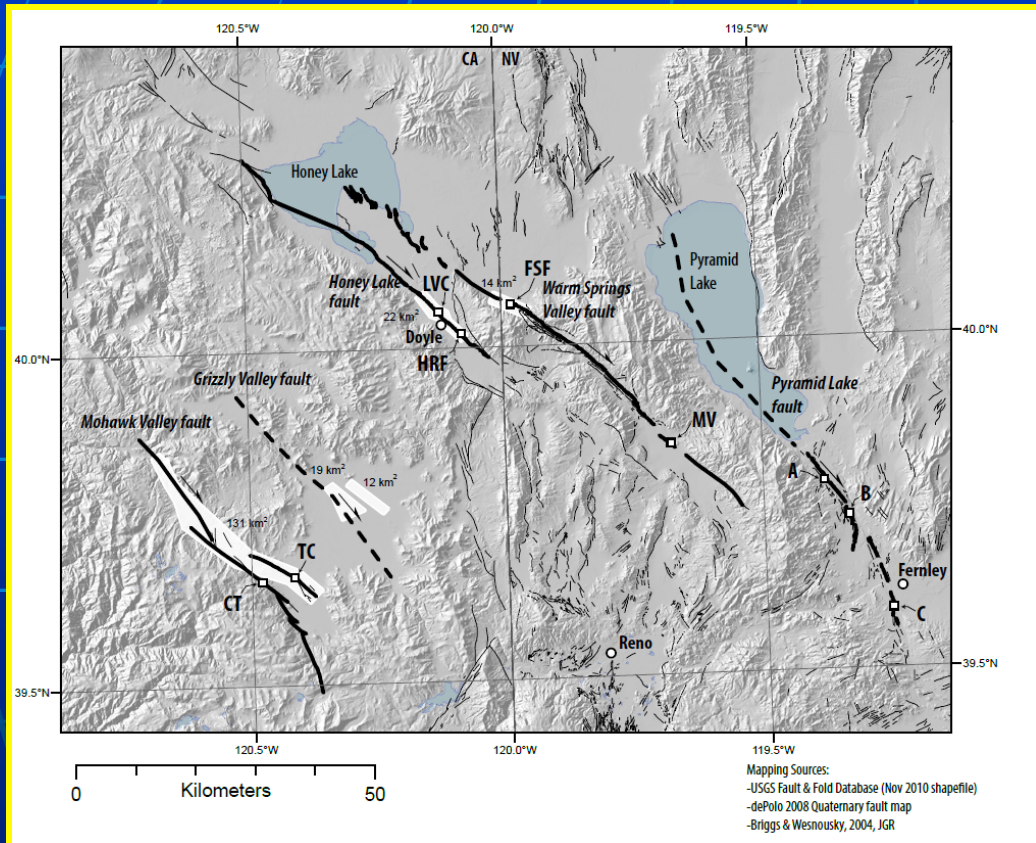


From Hammond and others, J. Geophys. Res., 2011

Western Nevada deformation: combination of extension and NW-directed shear related to motion along North America-Pacific plate boundary.

Geodetic data indicate about 6-7 mm/yr of dextral shear across Northern Walker Lane (NWL).

Northern Walker Lane (NWL) Investigations



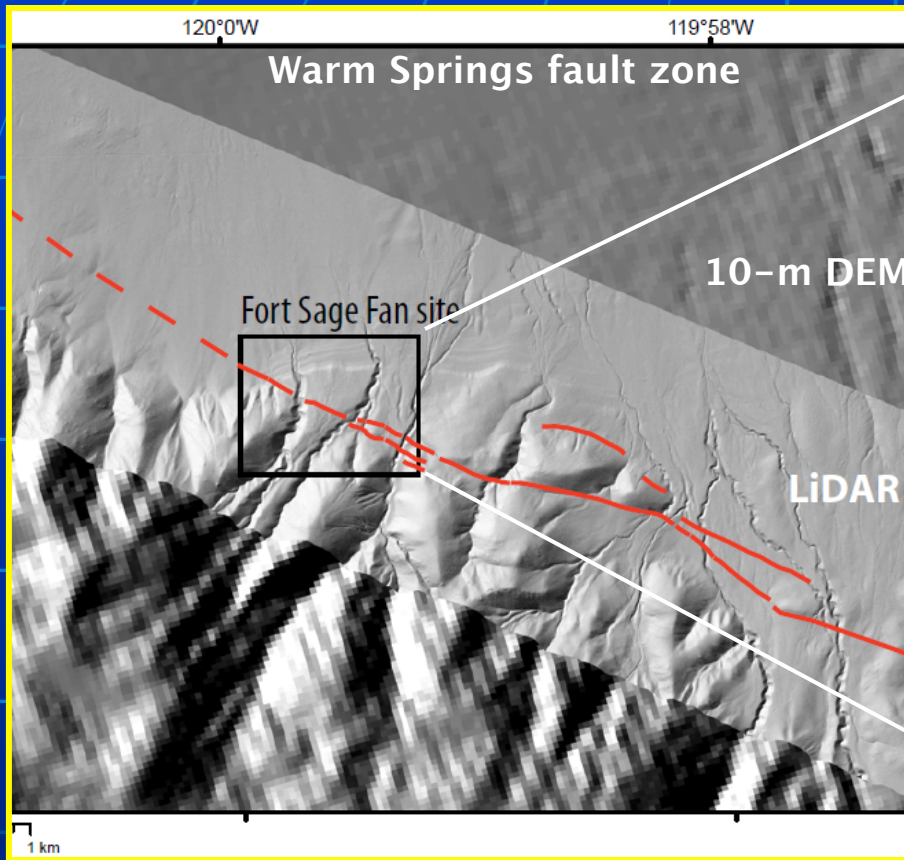
Key late Quaternary faults in NWL include Mohawk Valley, Sierra Valley, Honey Lake, and Warm Springs Valley.

USGS has collected high-quality LiDAR data across selected parts of the faults.

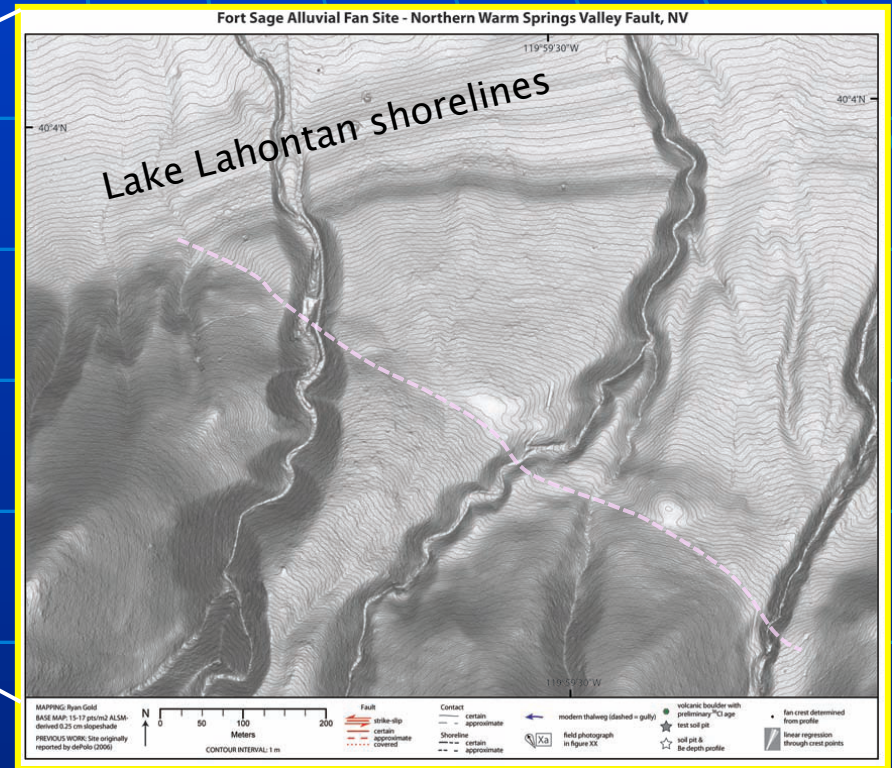
Data available at:
<http://www.opentopography.org>

Goal of studies: Obtain geological data to characterize long-term (geologic) rates vs short-term (geodetic) rates

Northern Walker Lane (NWL) Investigations



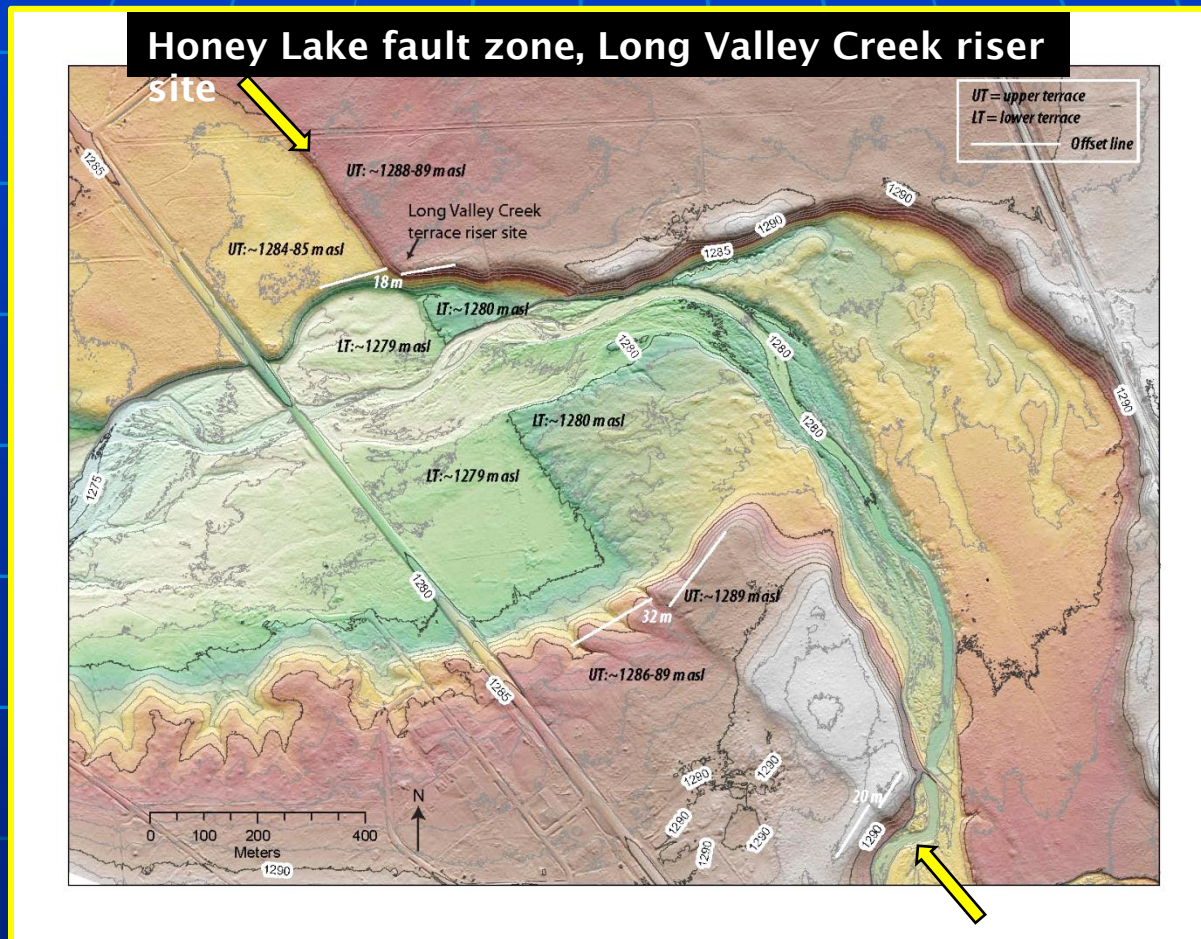
Fort Sage fan site



High-resolution LiDAR yields improved maps of fault traces.

Combination of surficial mapping, geochronology, and trenching are being used to determine long-term (geologic) slip rates for faults.

Northern Walker Lane (NWL) Investigations



Resolution of LiDAR permits detailed measurements of lateral offsets.

Selected Additional IMW Studies

Utah: Utah Lake faults
SLC ground motion modeling
Washington fault earthquake history
Weber County lateral-spread ground-failure maps

Nevada/Calif: Mohawk Valley and Honey Lake GPS
Genoa fault earthquake history
Mt. Rose fault zone imaging
Mogul earthquake extreme ground motions
West Tahoe fault studies

New Mexico: Albuquerque shear-wave analysis
Hubble Springs fault (Albuquerque area), NM

Why do we need hazard maps?



Wasatch fault,
American Fork Canyon
ca. 1985



Wasatch fault,
American Fork Canyon
2011