

Western US Floods: Eldorado Canyon Flood and other notable floods in Nevada

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February 17, 2011

Nevada

Semi-arid

State-wide precipitation is only 9 inches a year

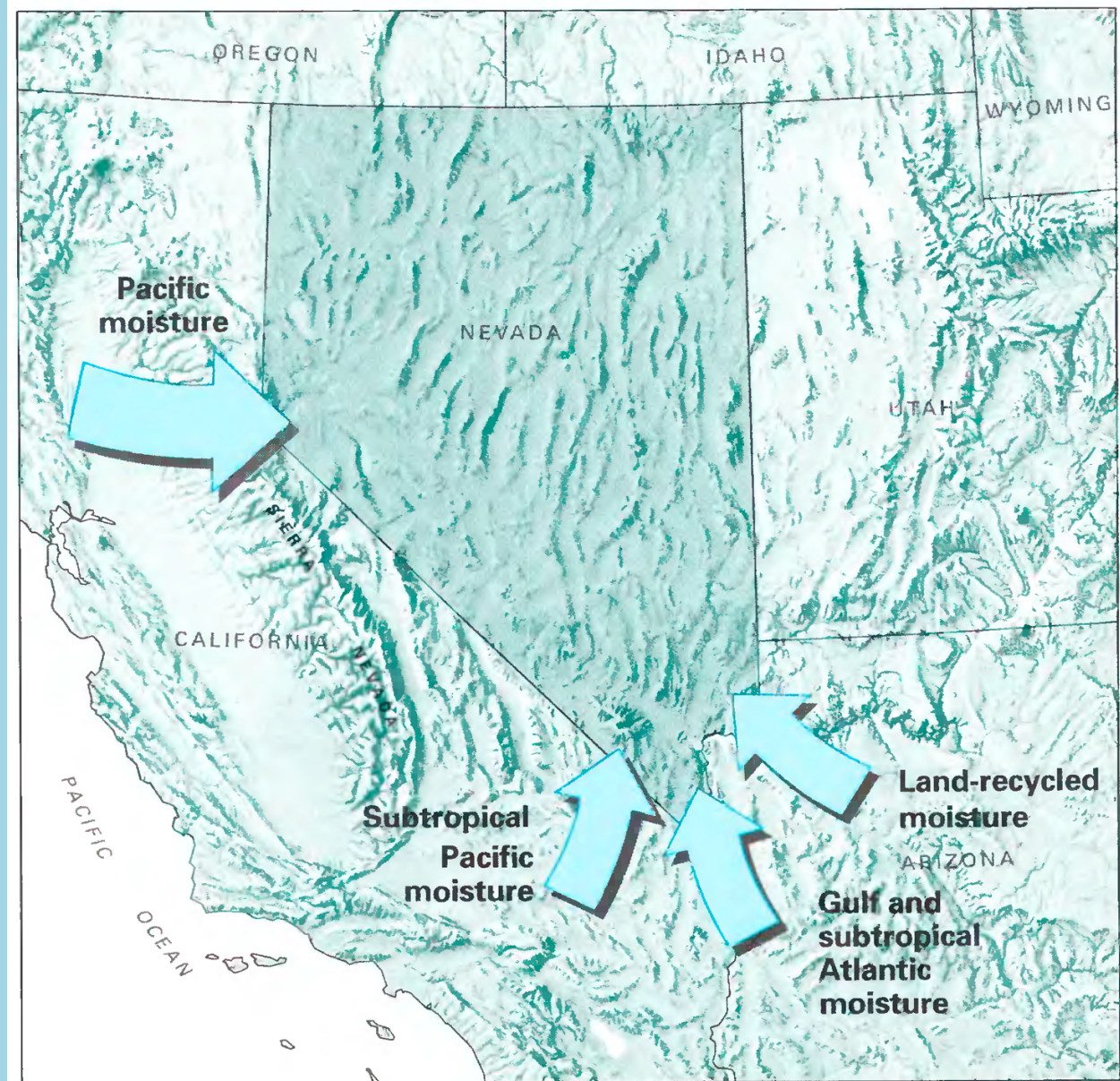
4 Major Sources

Pacific

Pacific Subtropical

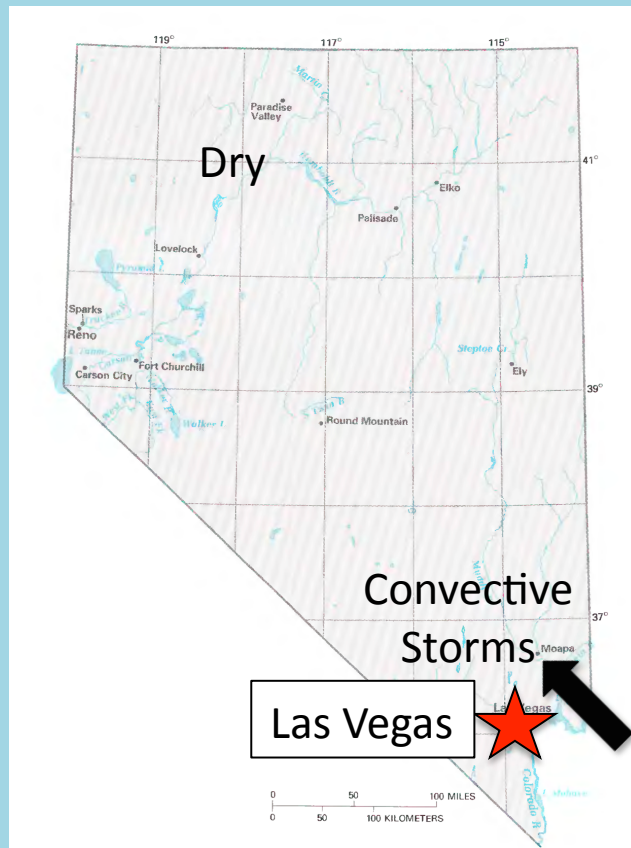
Gulfs

Land-Recycled

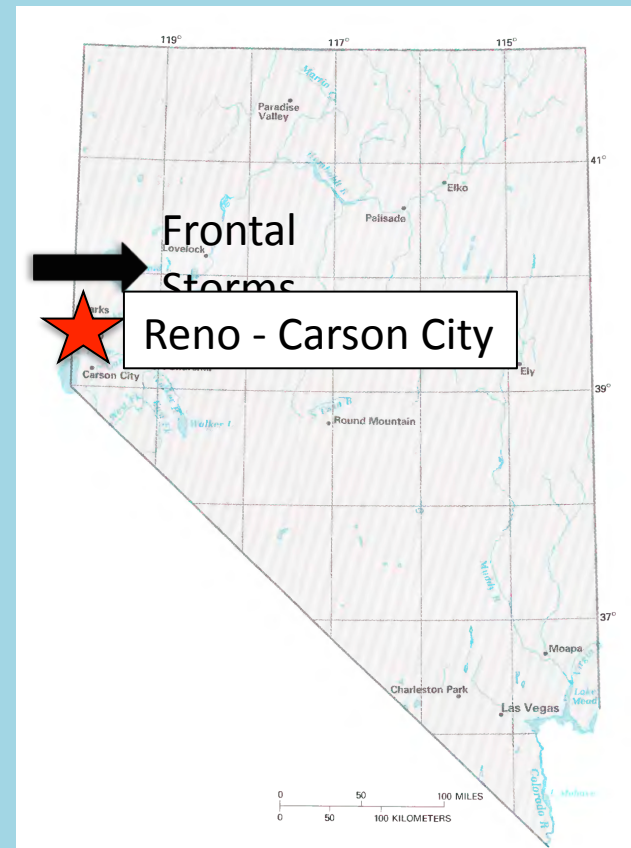


Seasonal Differences

April to September **WARM**



October to March **COLD**



Recycled Moisture from Lakes

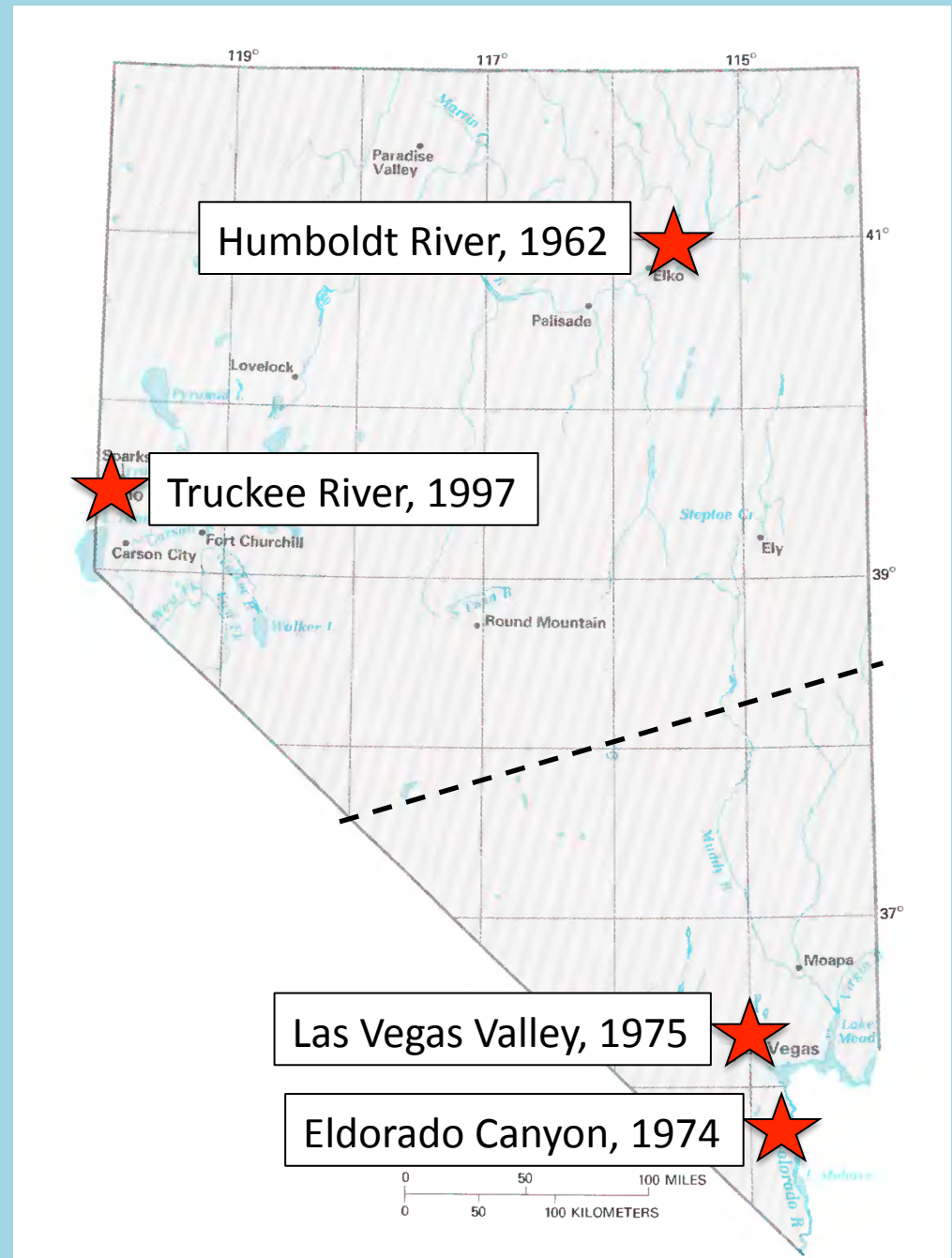
Nevada Floods

Northern Nevada

- Larger Drainage Basins
- Long Duration Rainfall
- Rain on Snow
- Snowmelt
- Gradual Onset of Floods
- Long Duration Floods
- Damage High

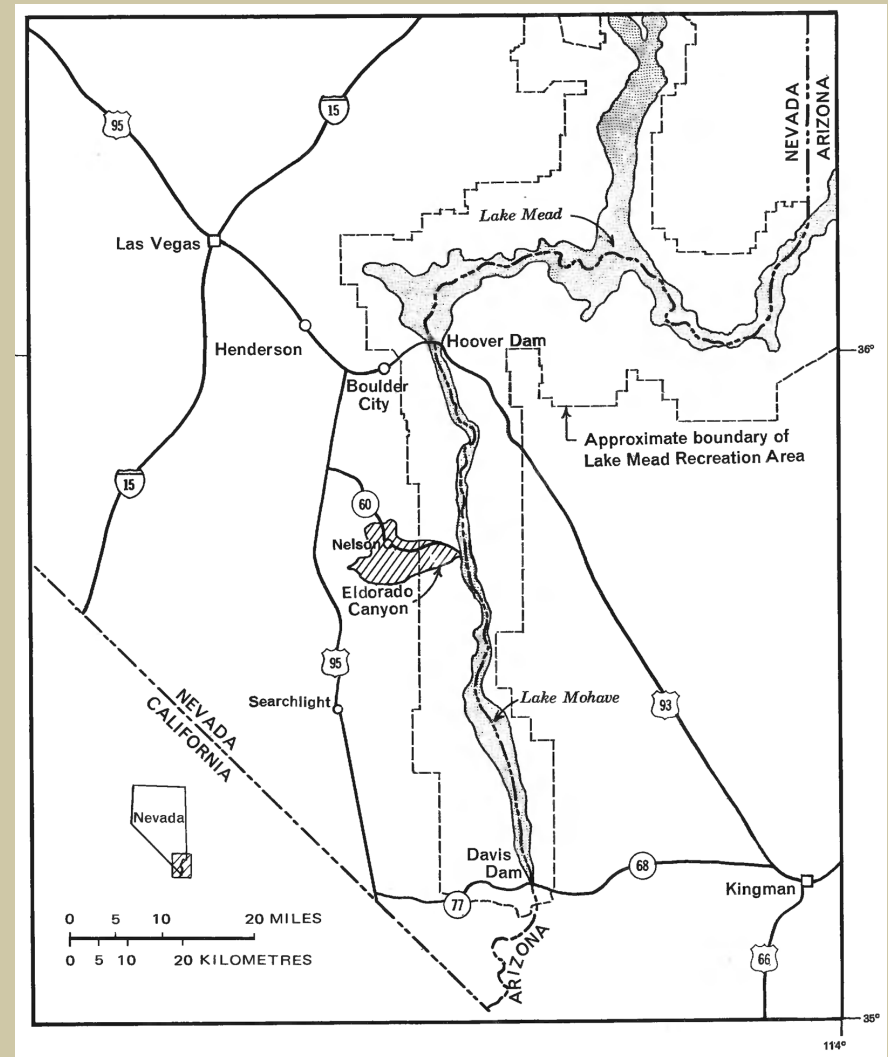
Southern Nevada

- Smaller Drainage Basins
- Short Duration Rainfall
- Flash Floods
- Sudden Onset of Floods
- Short Duration Floods
- Damage Low

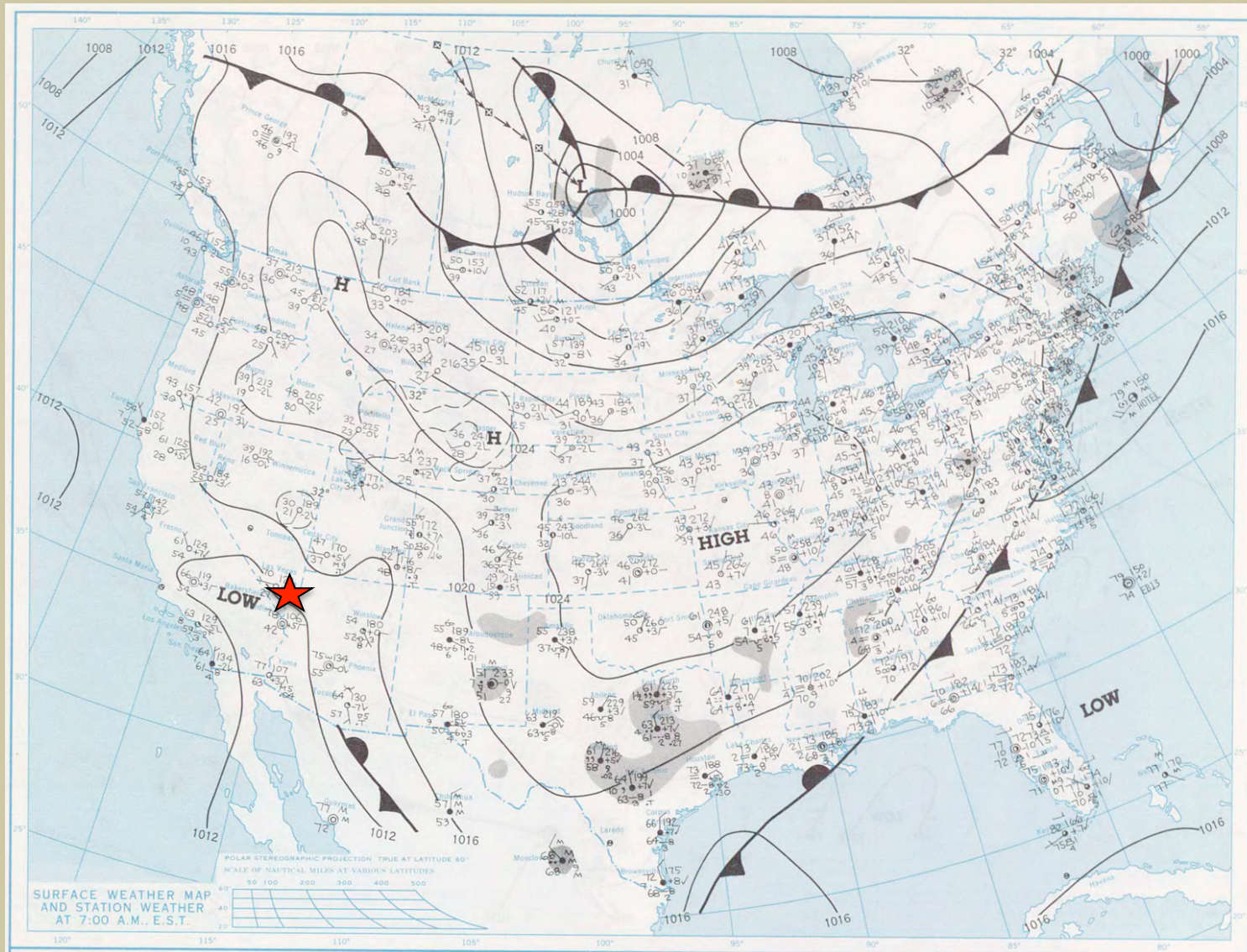


Eldorado Canyon Flood

- September 14, 1974 at about 2 pm
- Flash flood
- 9 people killed
- Magnitude was >100 year flood, but could happen anytime
- Past floods in 1904, 1952, 1959, 1960, 1970, and 1972 (witness statement)



Meteorology

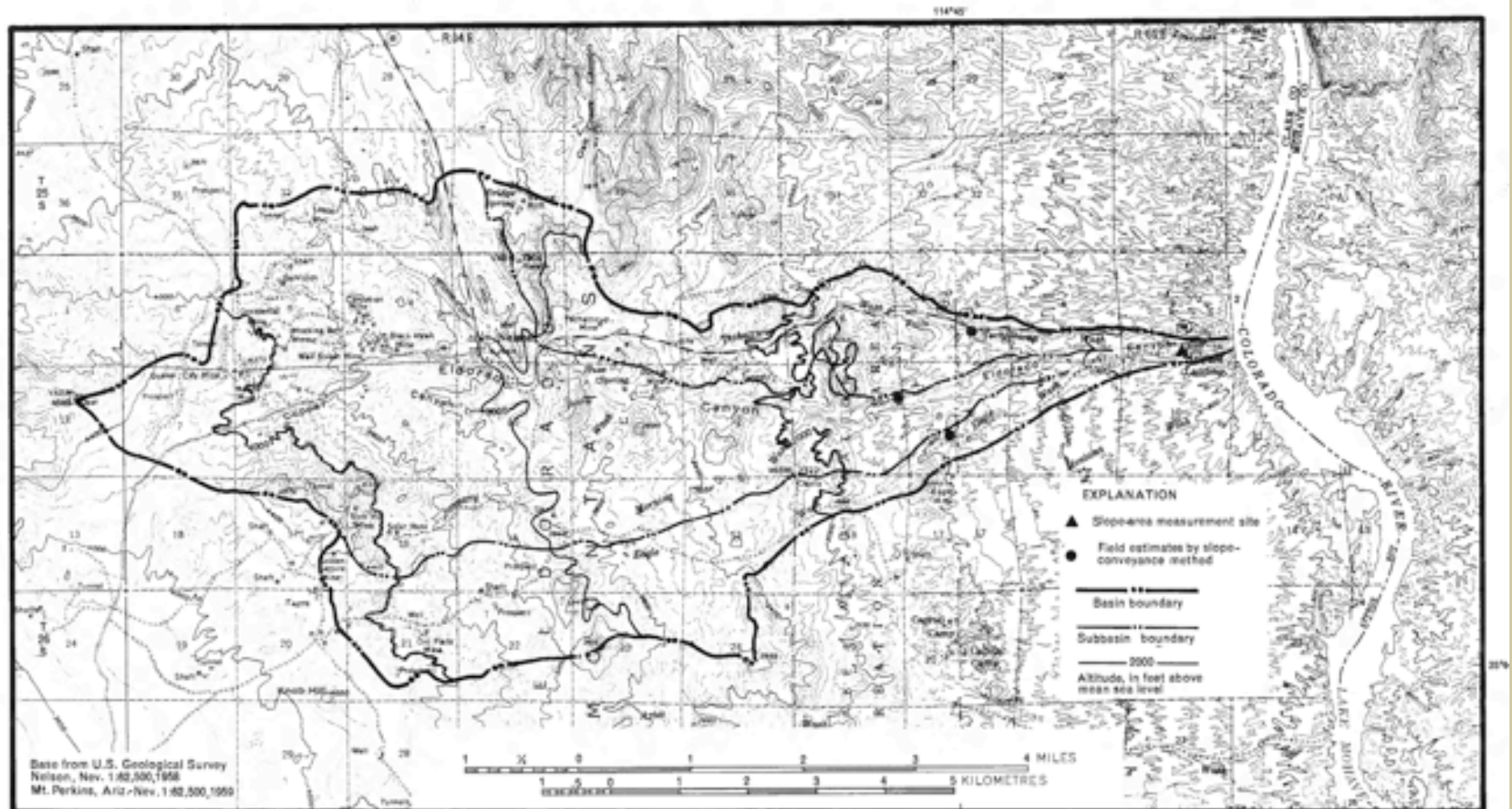


Storm

- Isolated convective storm
- 3 inches/30 minutes (hail and rain)
- ~1.5 hours total
- Storm track went downstream, intensifying as it went



Basin Characteristics



Basin Characteristics



- 22.9 square miles
- Average slope of about 350 ft. per mile (5-8%)
- Bedrock and alluvial basin
- Upper basin bedrock with thin soil and low vegetation density
- Lower channel alluvial for last 2 miles

Flood

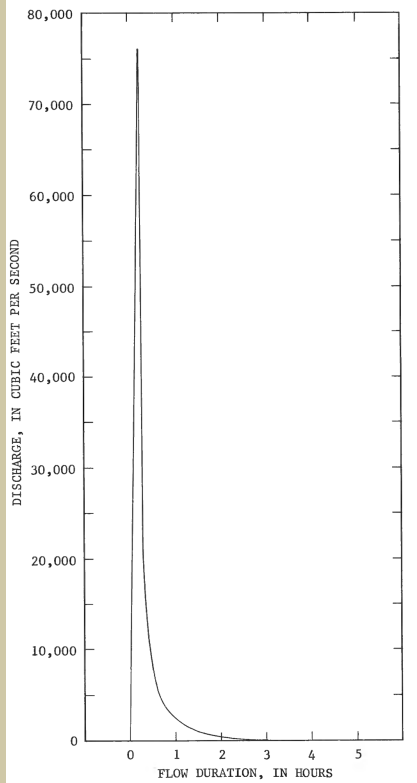


FIGURE 11.—Estimated flood hydrograph for September 14, 1974, near mouth of Eldorado Canyon.

- Wall of water with sediment and debris
- Following surges never receded, only built up
- Peak wave of ~76,000 cfs (estimate) after initial wave

TABLE 2.—Summary of hydraulic data resulting from peak-flow estimates

Determination type and location ¹	Estimated peak discharge (ft ³ /s)	Measured cross-sectional area (ft ²)	Estimated mean velocity (ft/s)	Approximate tributary area (mi ²)	Estimated unit runoff [(ft ³ /s)/mi ²]
<i>Slope-area method</i>					
Eldorado Canyon below Eagle and Techatticup Washes	76,000	(²) { 3,030 2,230 1,920	(²) { 25 34 39	22.8	3,300
<i>Slope-conveyance method</i>					
Eldorado Canyon above confluence with Eagle and Techatticup Washes	24,000	1,010	24	13.0	1,800
Eagle Wash near mouth	25,000	807	31	4.5	5,600
Techatticup Wash near mouth	11,000	421	26	3.2	3,400

¹Measurement sites shown in figure 3.

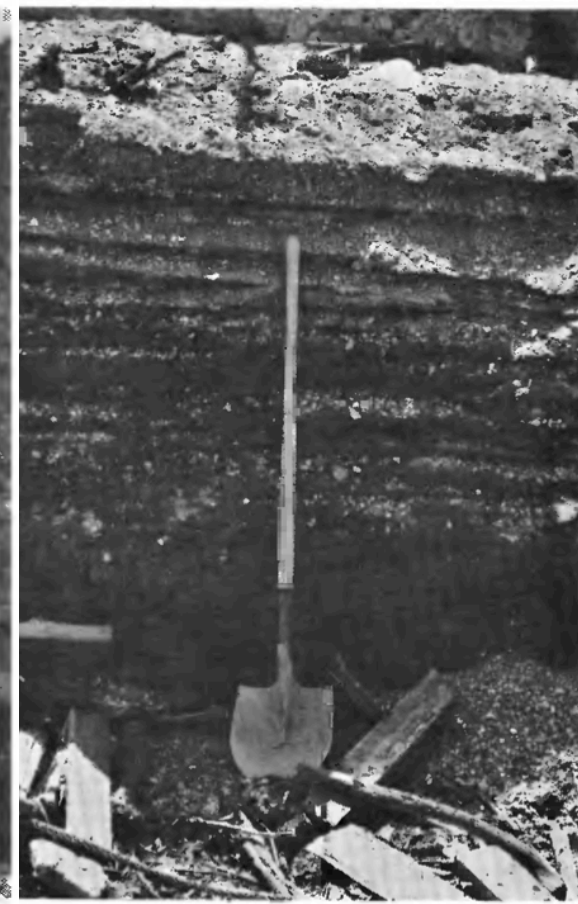
²Values for individual cross sections.

- 1:30 pm – Flooding at Nelson (mid-basin)
- 2:00 pm – Flooding at Eldorado Canyon Resort (mouth)
- Largest discharge at mouth of canyon
 - Downstream storm track
 - Convergence of basins
 - Bedrock constriction

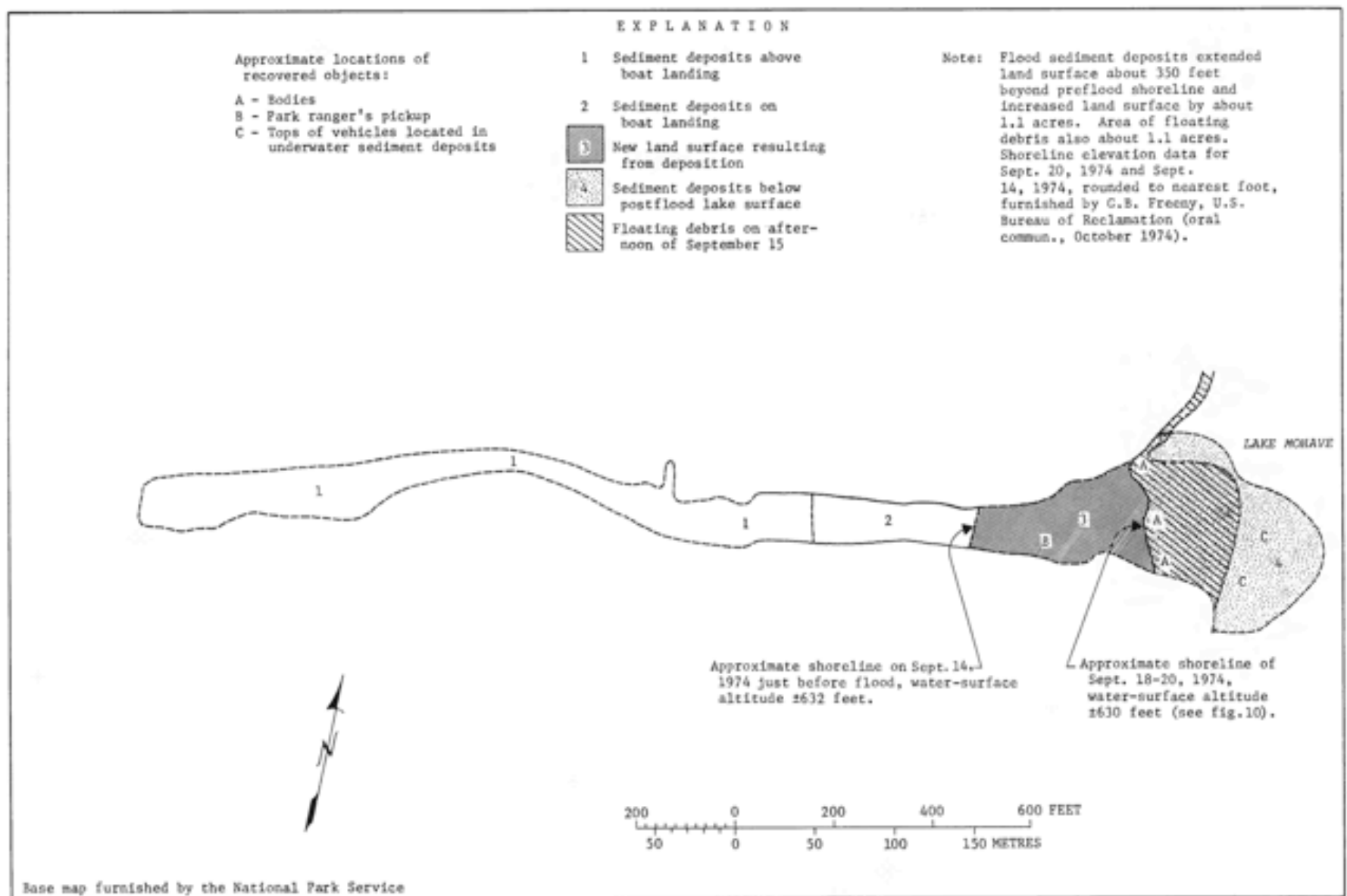


Erosion and Sedimentation

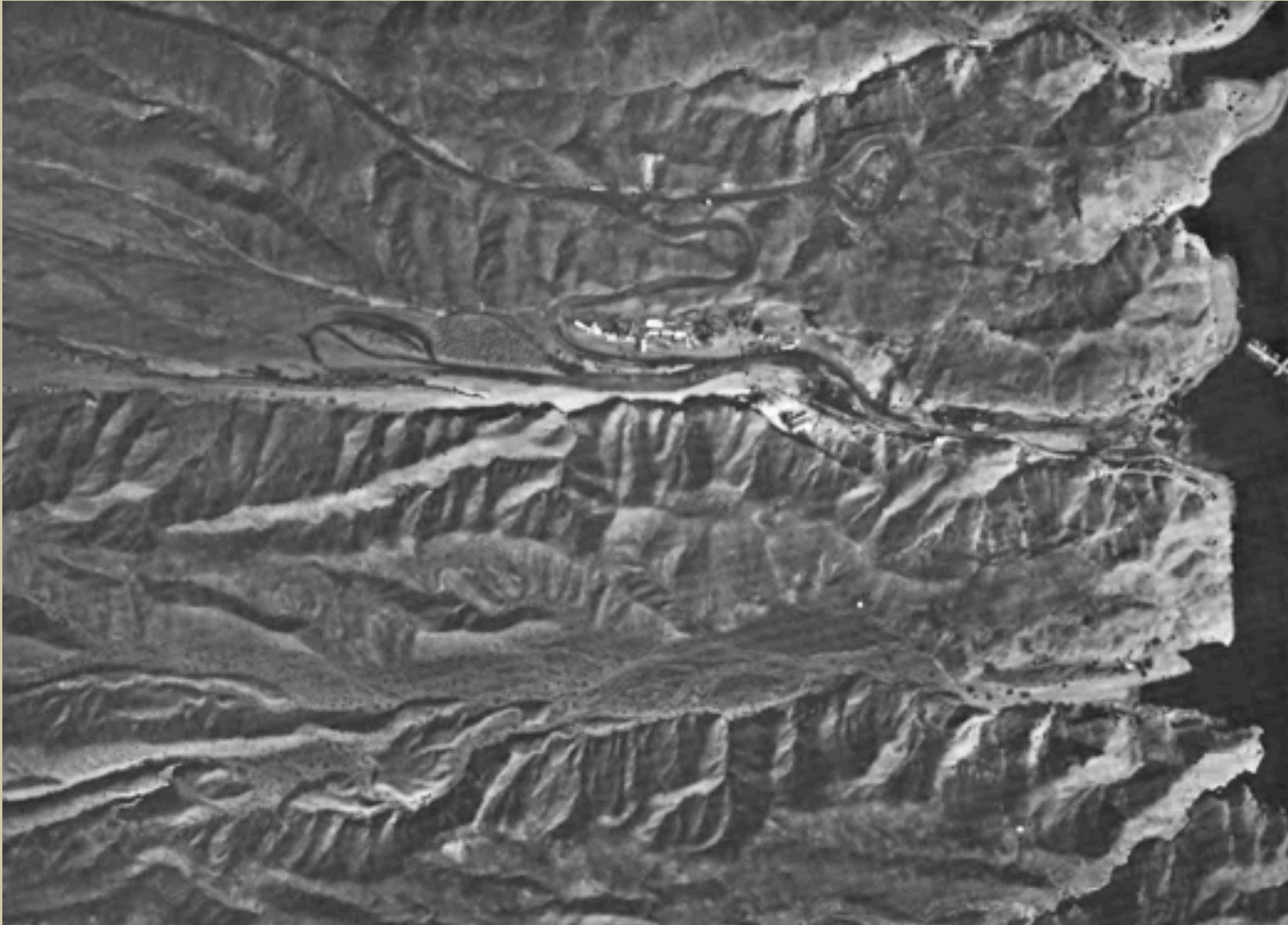
- Erosion in lower basin
- 12 ft. of sedimentation



Sedimentation = New Land



Lake Mojave



Human Factor



9 lives, homes, restaurant, buildings,
dock, vehicles, boat trailers, boats,

- Nelson and Eldorado Canyon Resort
- 50 miles S of LV and on a Saturday
- Witnesses to the flood
- Precipitation at mouth of canyon drove people to shelter, NOT out of the canyon

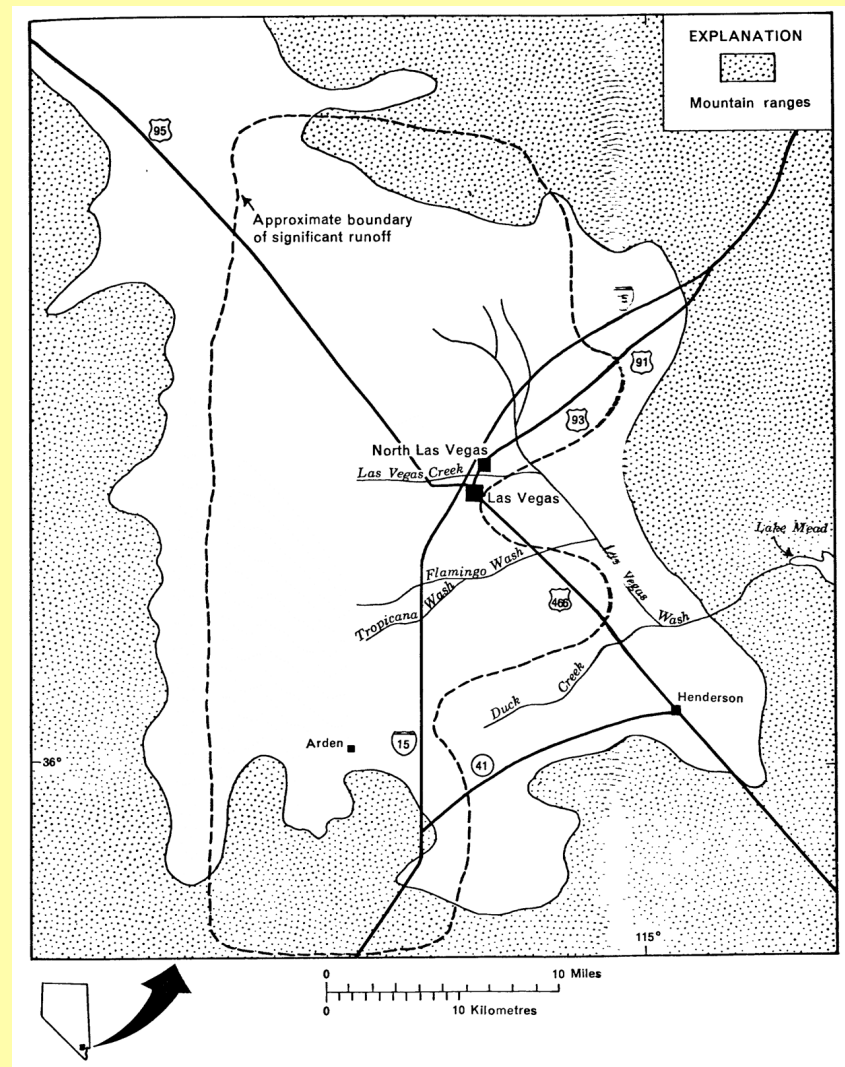
Summary



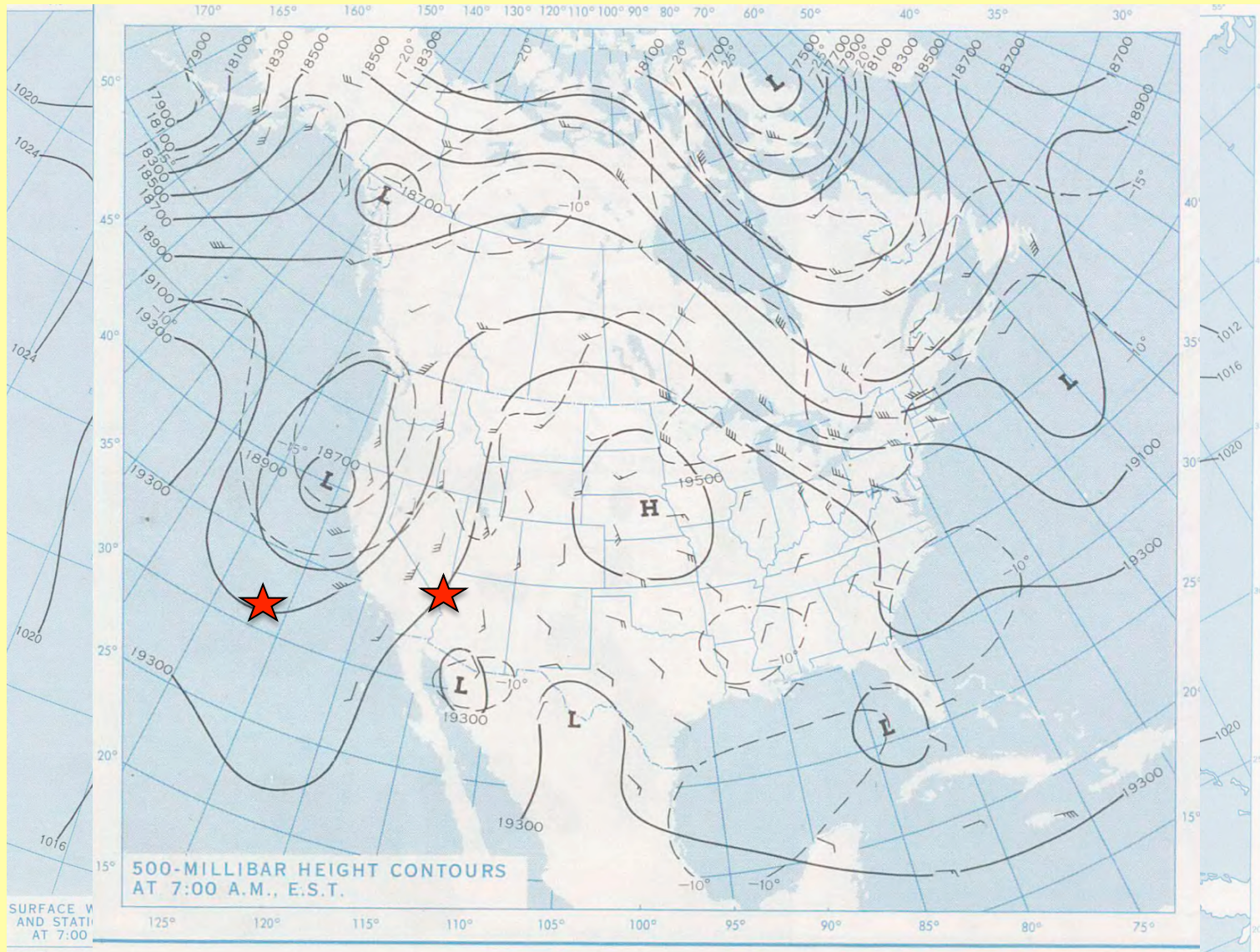
- High, increasing precipitation intensity
- Large quantity of precipitation
- Downstream storm track
- Time of occurrence
- Nature of storm at mouth of stream
- Basin geomorphology

Las Vegas Valley Flood

- July 3, 1975, afternoon
- Also flooded in July 1983 and 1984
- Unknown recurrence interval
- 2 people killed
- Similar to Eldorado Flood, but more damage due to location



Meteorology



Storm

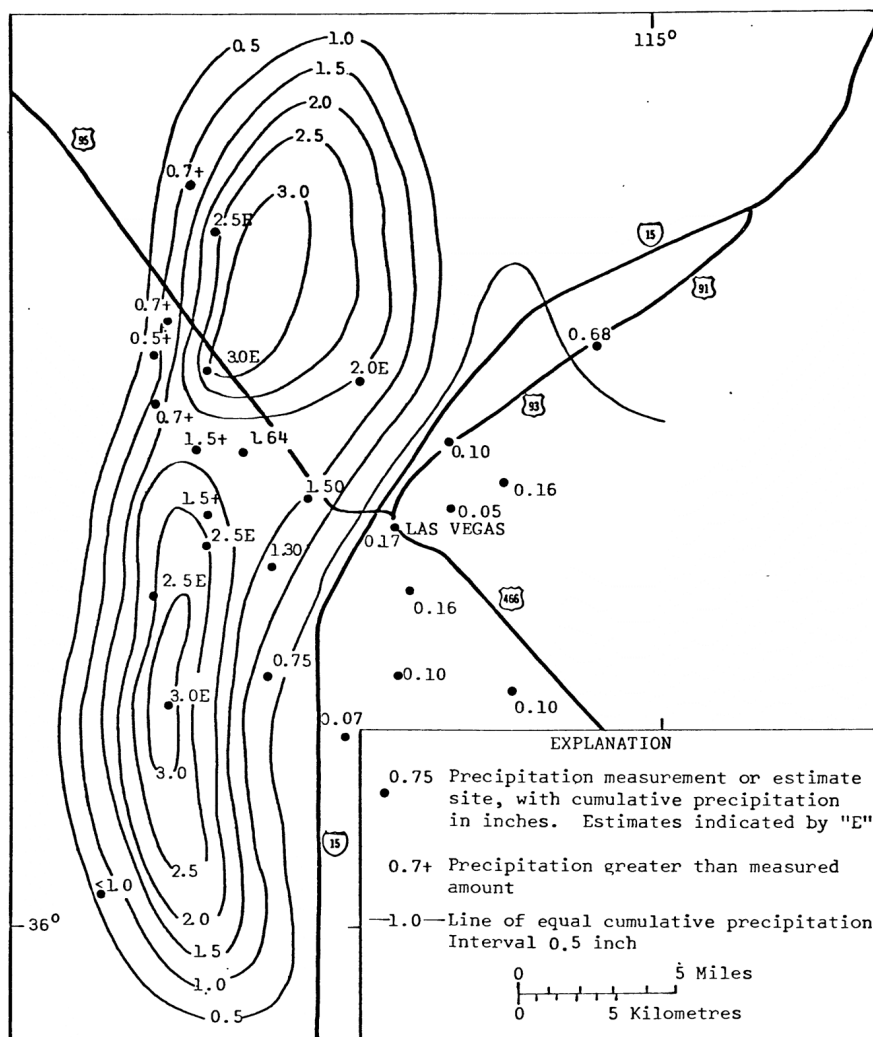


Figure 2.--Cumulative rainfall during storm of July 3, 1975. Map from Darryl Randerson (National Oceanic Atmospheric Administration, written commun., 1975).

- Total precipitation exceeded 3 inches
- Involved only lower basin, no mountainous areas
- Moved southwest to north, not up or down stream

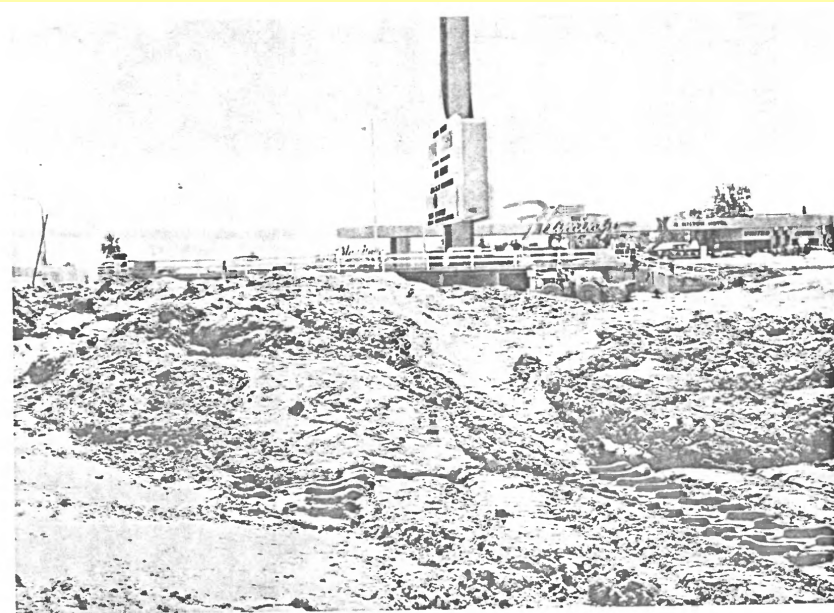
Flood



- Affected 4 streams
 - Las Vegas Creek
 - Las Vegas Wash
 - Flamingo Wash
 - Tropicana Wash
- Peak discharge
 - Las Vegas Wash
13,000 cfs
 - Flamingo Wash
4,000 cfs

Human Factor

- Highly populated area
- 4-5 million dollars in damage



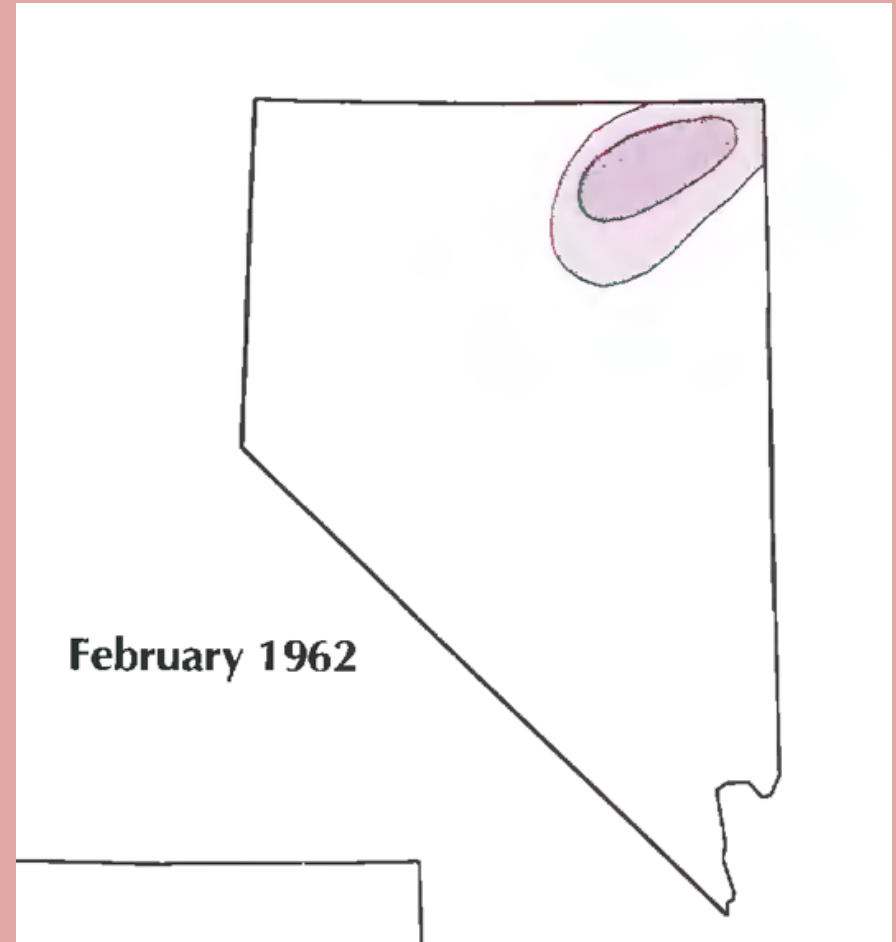
Summary

- Highly populated area = more damage
- Flash flood like Eldorado, but
 - Larger basin
 - Different shape of basin
 - Only lower basin was hit
 - Lower amount of rainfall
 - Lower intensity rainfall
 - Storm track was not up or down stream



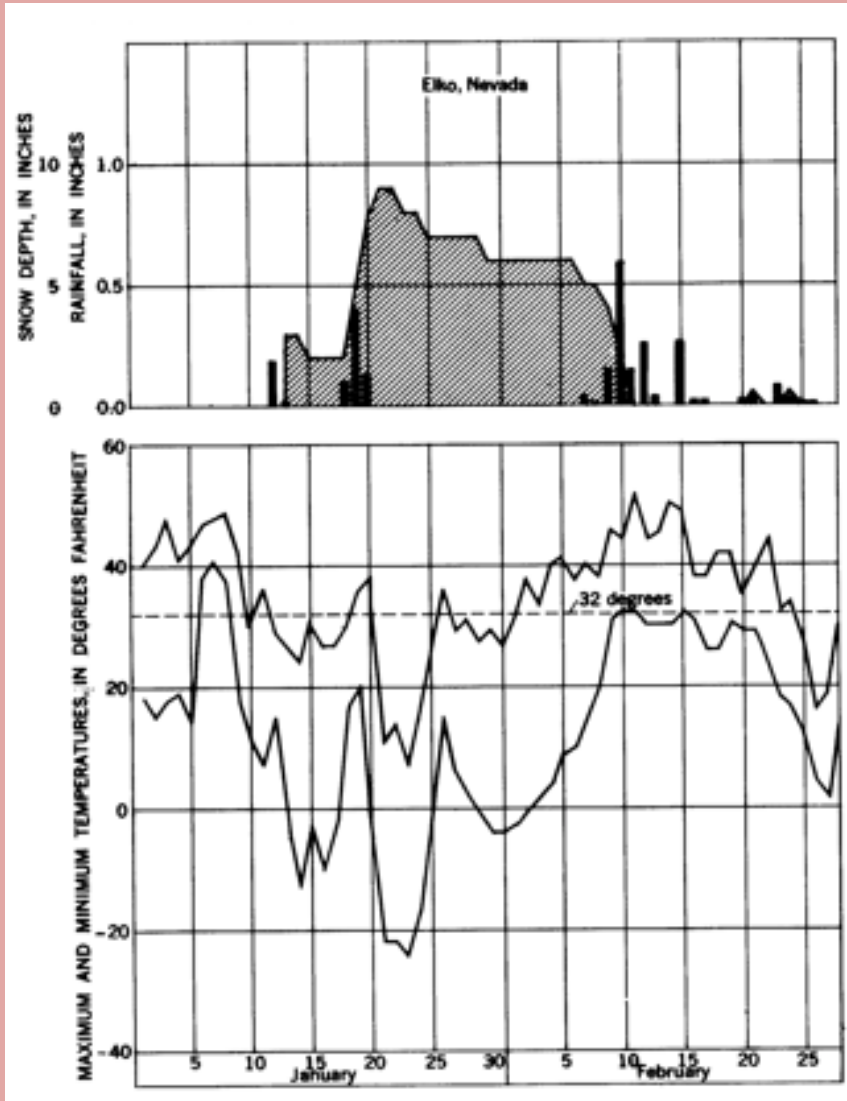
Humboldt River Flood

- February 10-12, 1962
- Floods in NE Nevada and SW Idaho
- >50 year flood, some cases 100 year flood
- 1.5 million dollars in damages in Nevada



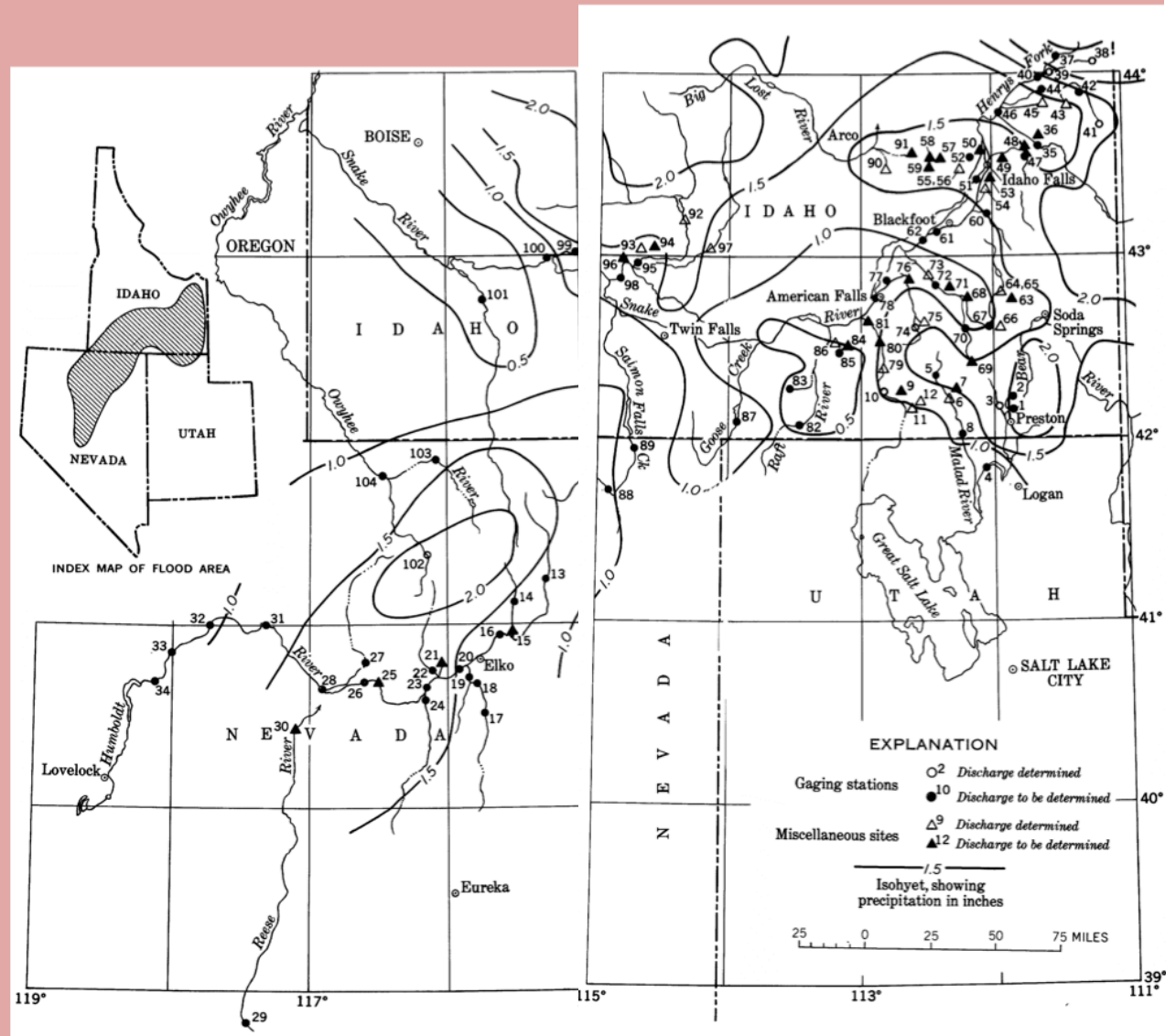
Scenario

- Abnormally cold and wet winter = large snowpack at low elevations
- Followed by warm temperatures (30-50 F) and light rainfall

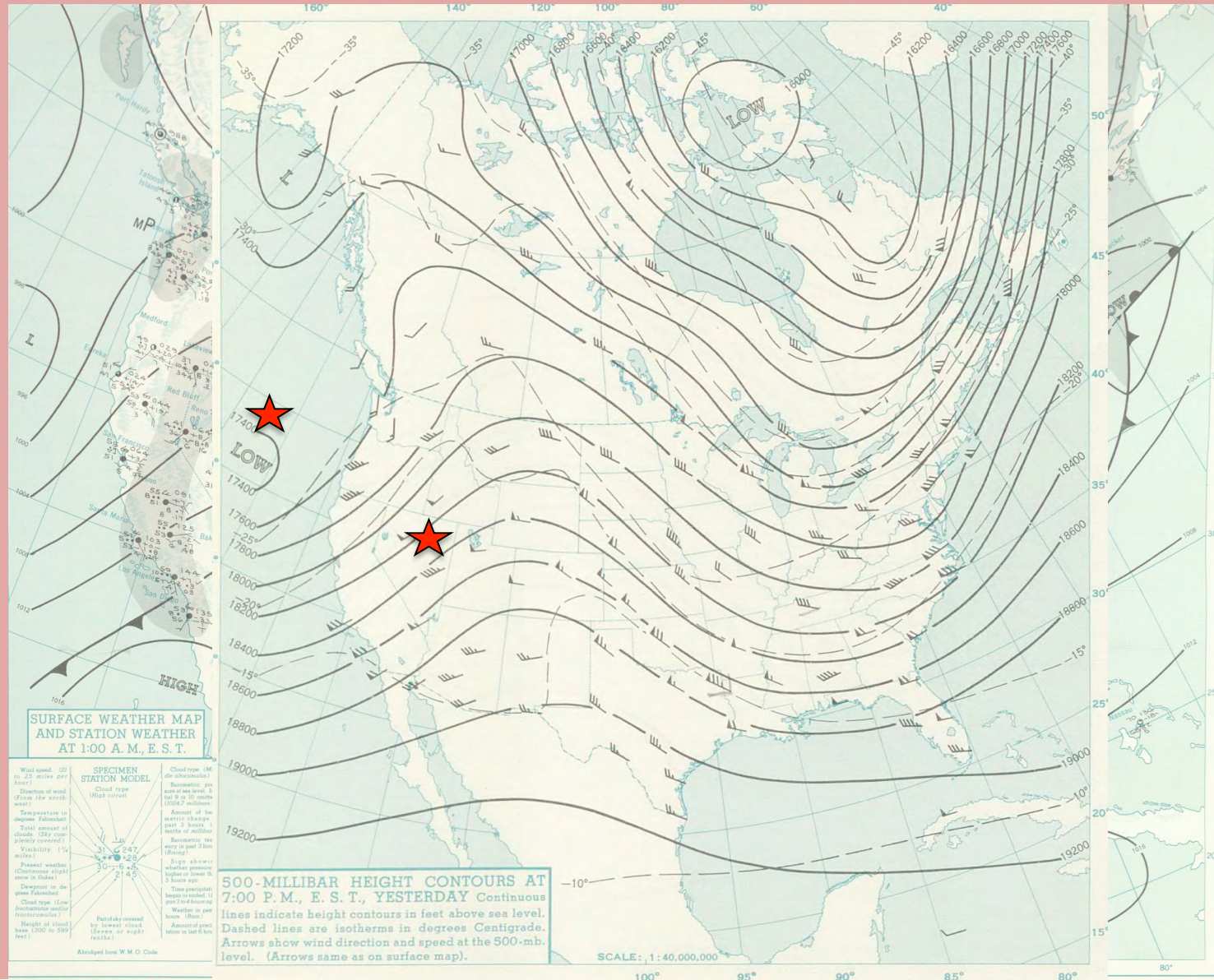


Storm

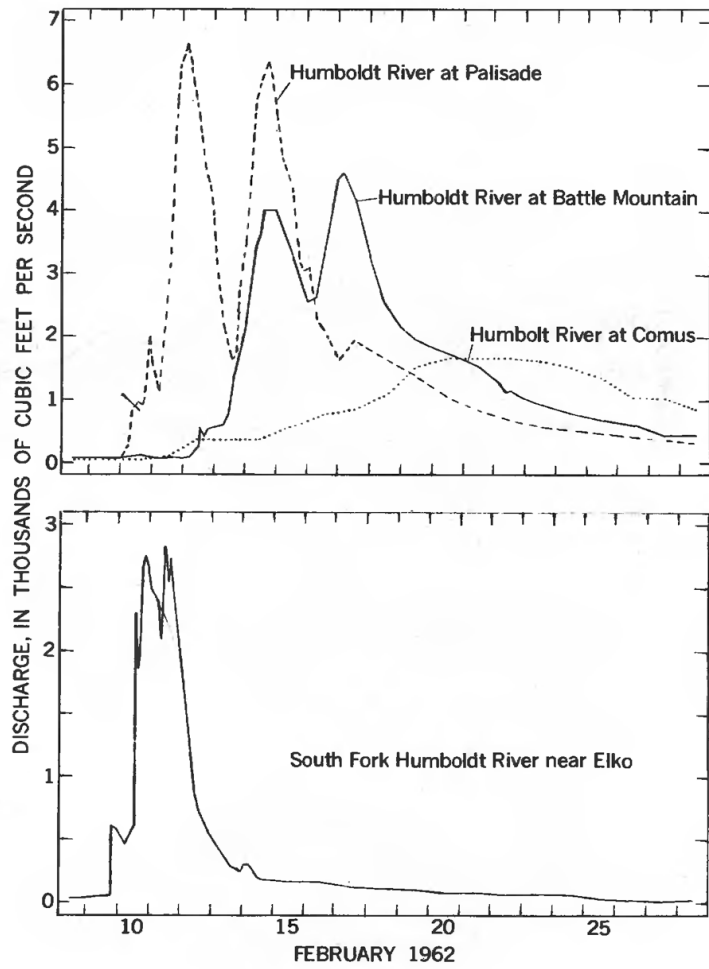
- .5 to 2 inches of rainfall
- Flooding in Nevada and in Oregon and Idaho
- Many rivers reached >100 year floods



Meteorology



Flood

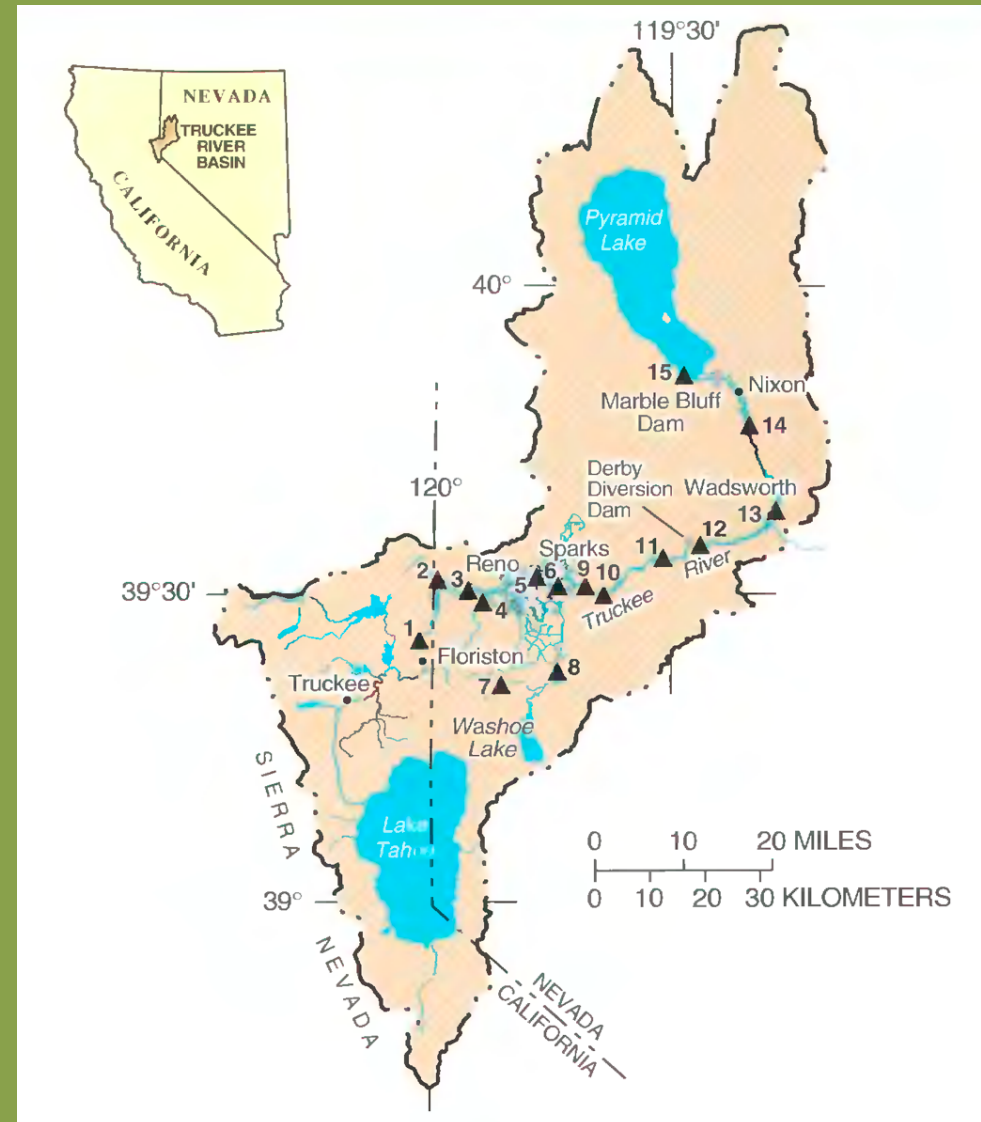


Summary

- Large snowpack
- Warm temperatures and light rainfall
- Rain on Snow
- Western Type III Storm
- Regional storm over Idaho, Oregon, and Nevada

Truckee River Flood

- January 1-3, 1997
- \$540 million in damage
- Extensive flooding of downtown Reno and Reno/Tahoe International Airport



Scenario

- Build up of huge snowpack over the Sierra Nevada
- Unseasonably warm rain on snow
- Total of 1.9 inches of rain in Reno
- Peak discharge of 21,200 cfs (~ 50-year flood)

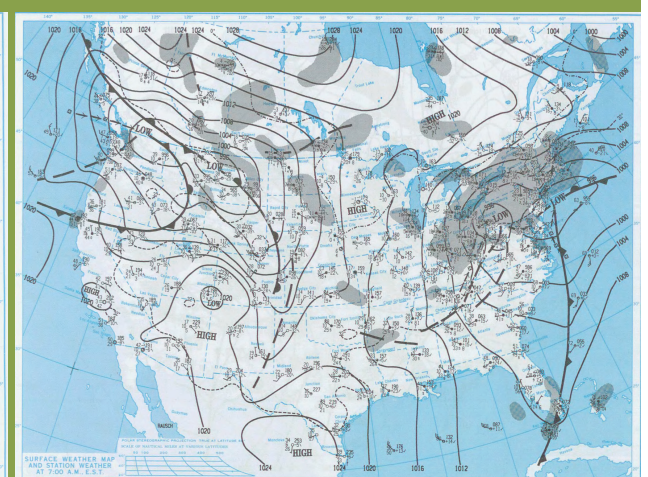
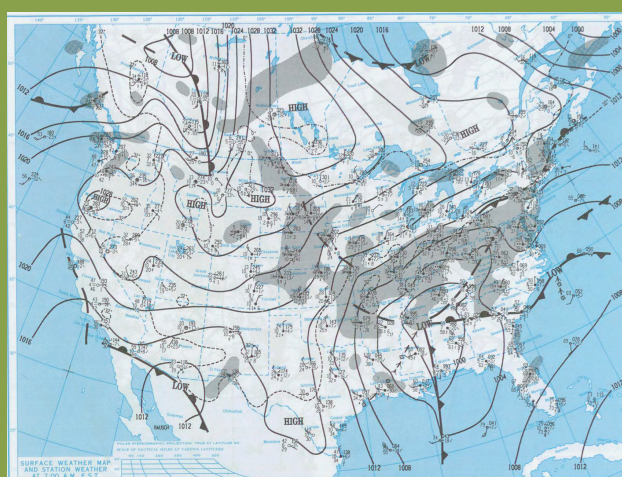
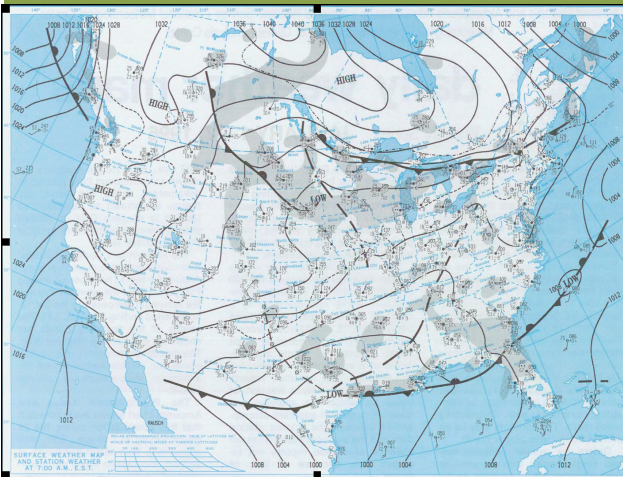
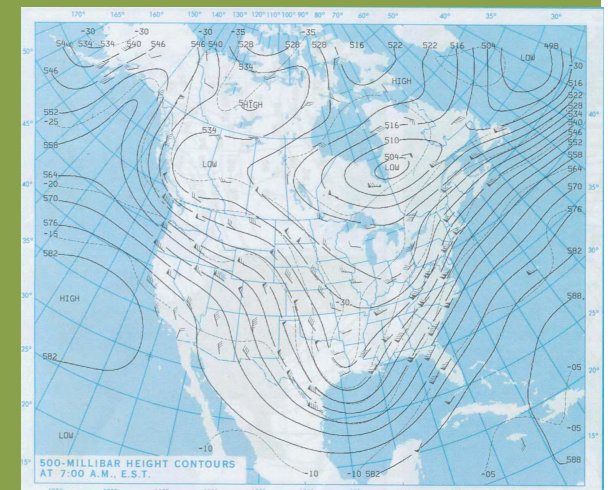
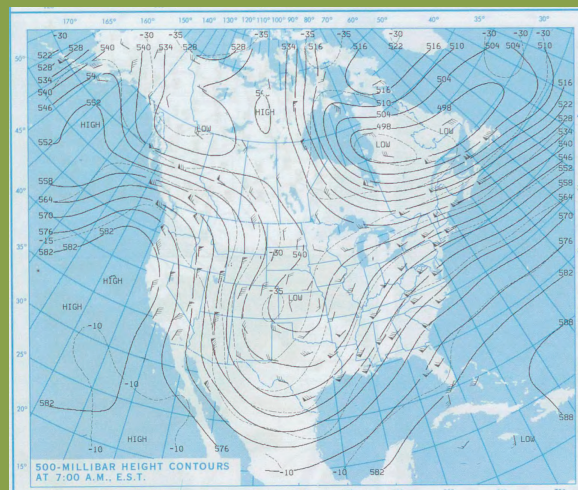
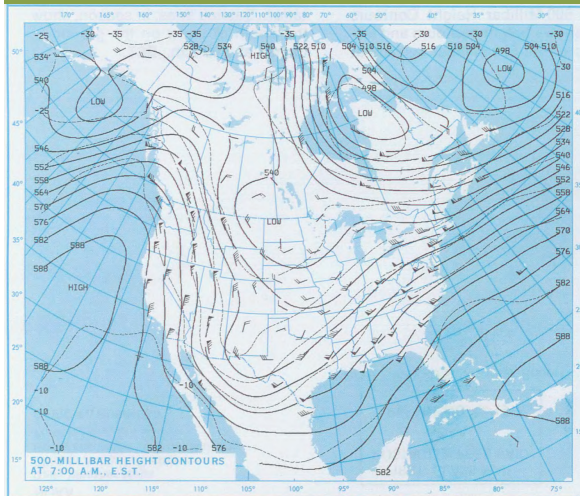


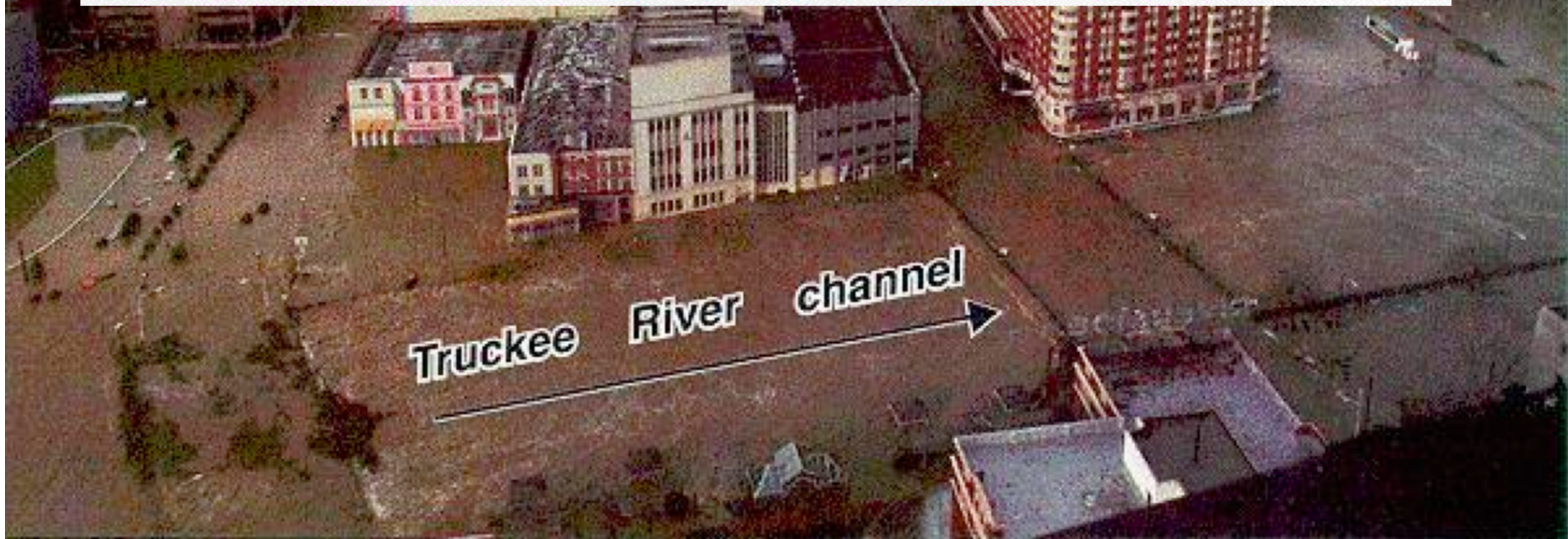
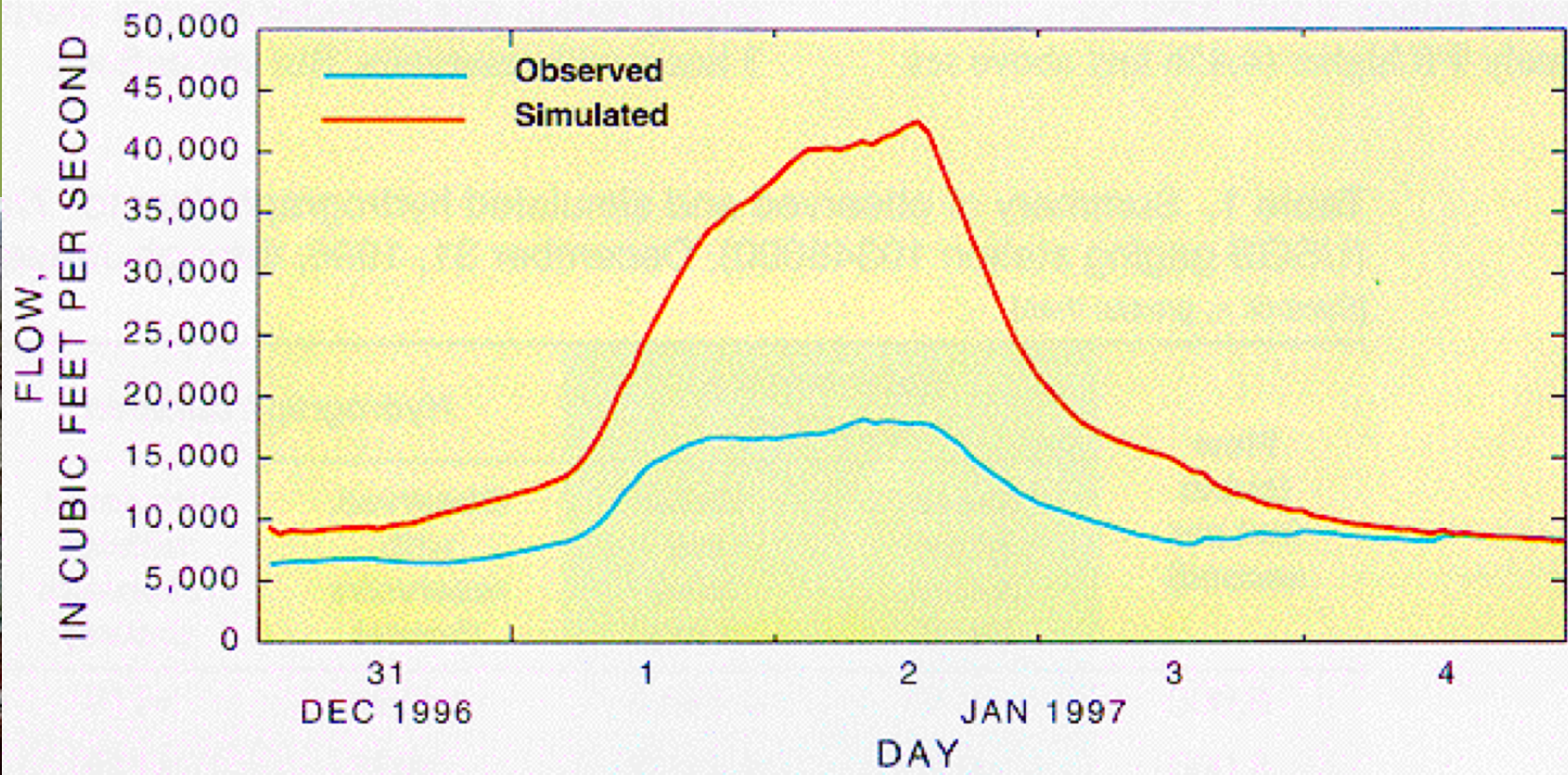
Meteorology

January 1

January 2

January 3





Summary

- Large snowpack
- Unseasonably warm rain on snow
- Rain on Snow
- Peak discharge of 21,200 cfs (~ 50-year flood)
- Higher damages due to higher population

Summary

- Nevada has two distinct flood regime areas
 - North (Humboldt and Truckee Floods)
 - South (Eldorado and Las Vegas Floods)
 - Hybrid
- Nevada has 4 moisture sources
 - Pacific Polar
 - Pacific Subtropical
 - Gulf of California/Gulf of Mexico
 - Land-Recycled

Summary

- Important Flood Ingredients
 - Areal coverage of storm
 - Precipitation intensity
 - Total rainfall amount
 - Basin shape and size
 - Portion of basin precipitated on
 - Storm track
 - Timing



Questions?