

Integrating Climate and Watershed Modeling to Improve Bridge Design

Iowa DOT Climate Change and Extreme Weather
Vulnerability Assessment and Adaptation Project

August 21, 2014



Project Partners

Lead: Iowa DOT (Dave Claman, Hydraulic Engineer)

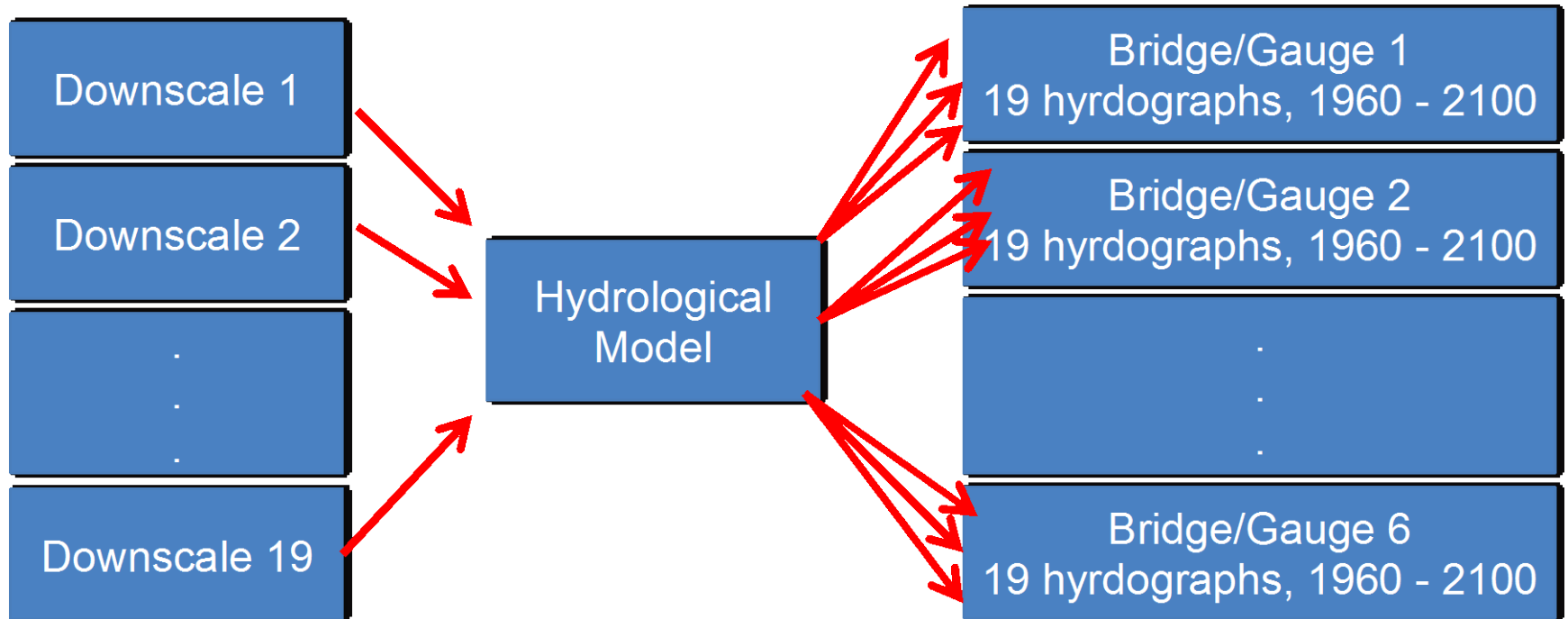
Iowa State University (Christopher J. Anderson, Eugene S. Takle)

- Climate science and climate projection expertise
- Lead and contributing authors to IPCC AR4, NCA Agriculture

University of Iowa IIHR (Witold F. Krajewski, Ricardo Mantilla)

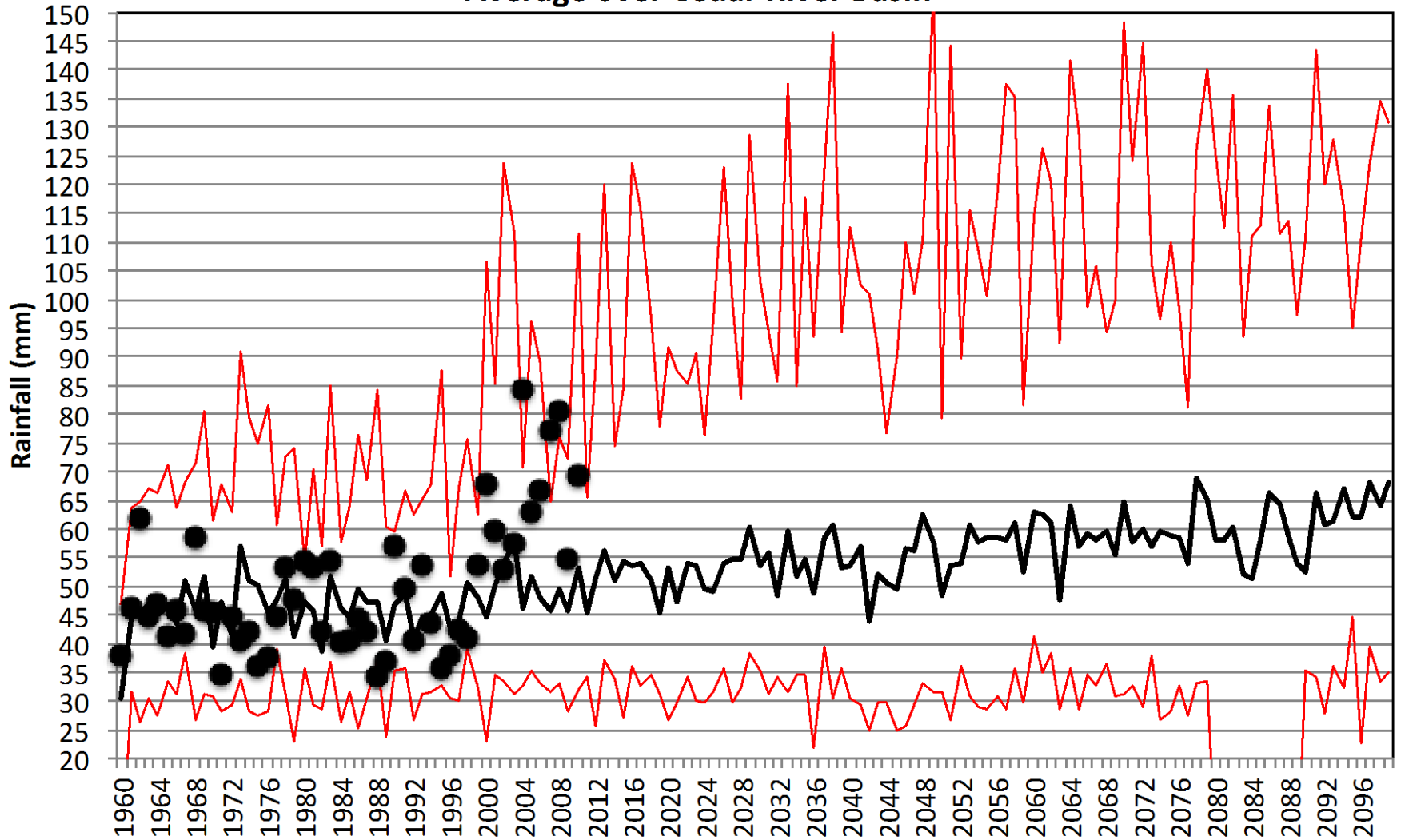
- Hydrology and hydraulics engineering and modeling
- Iowa Flood Center: ifis.iowafloodcenter.org

Simulation Design



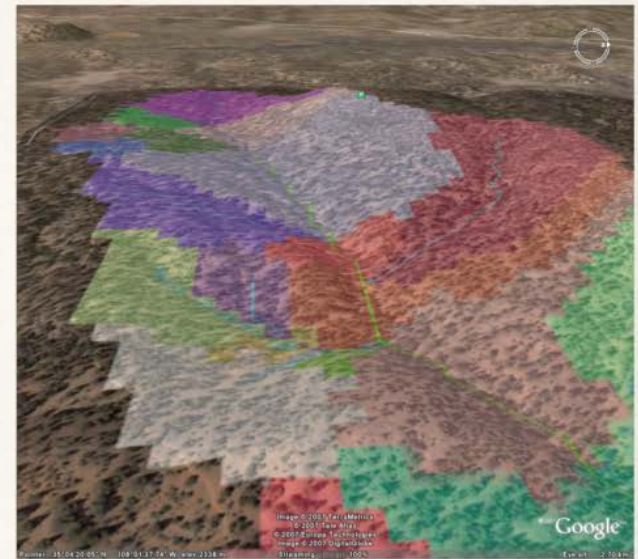
Projected Change Annual Maximum Precipitation

Annual Maximum Precipitation
Average over Cedar River Basin



Hydrological model discretization

hillslope area: $\sim 0.05\text{km}^2$

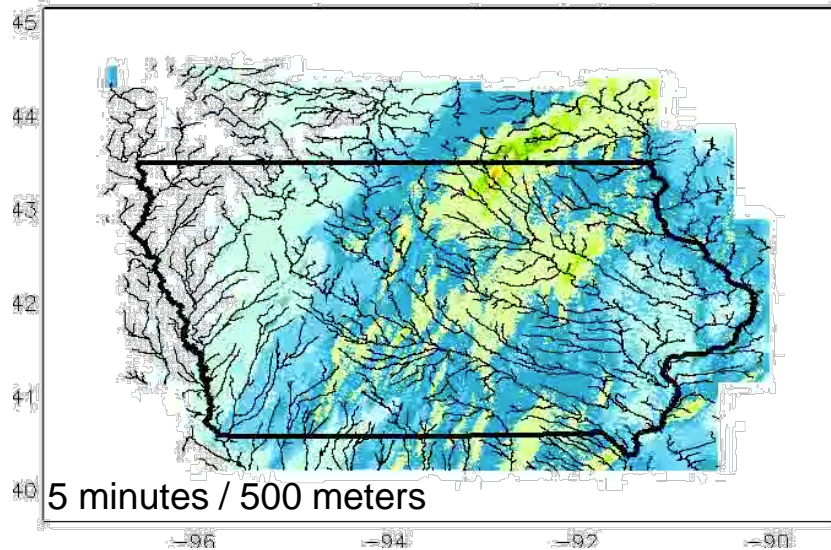


The model provides
hydrographs everywhere in the
drainage network

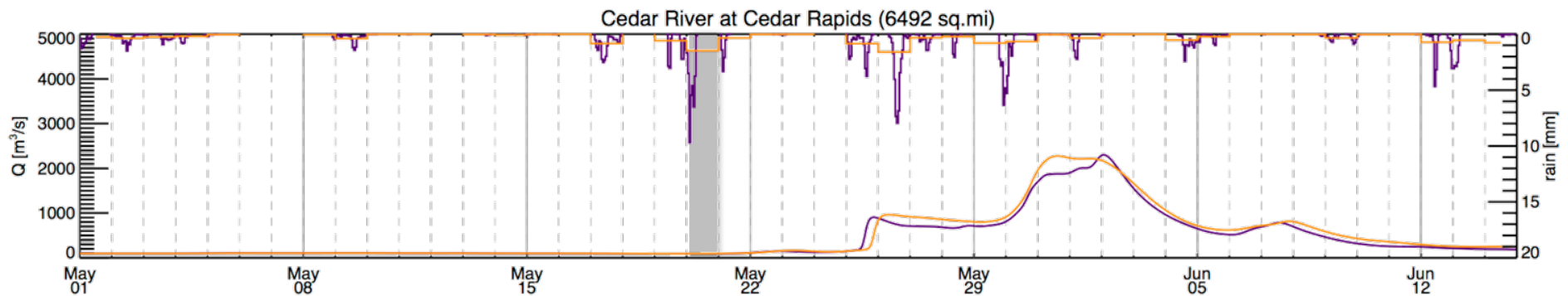
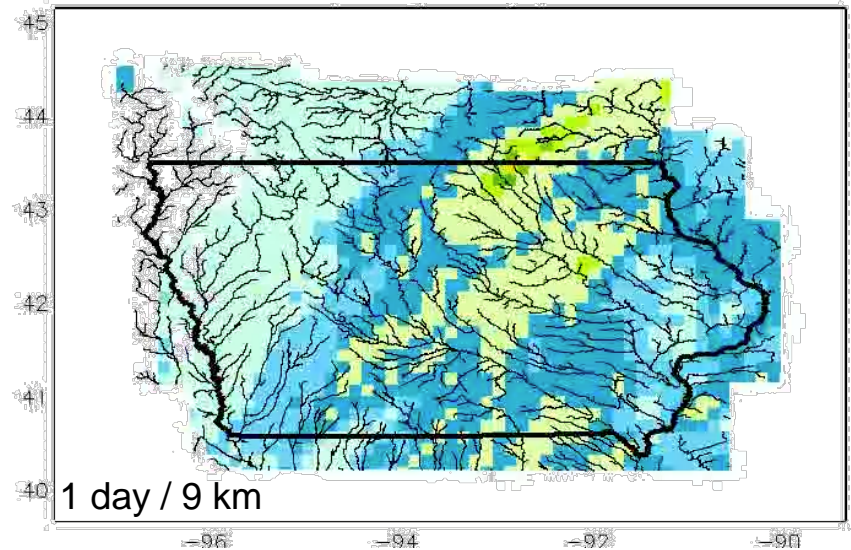


IMPACT OF RAINFALL AGGREGATION

Raw IFC Rainfall Radar 2013/05/21 UTC



Aggregated Rainfall 2013/05/21 UTC



Upper Iowa River

Des Moines River Basin

Cedar River Basin

Skunk River Basin

DRAINAGE BASINS
OF IOWA



Prepared By
Office of Transportation Data
Cartographic Section
Phone (515)239-1282
March 1, 2000

MISSOURI RIVER BASIN

- Boyer River
- Chariton River
- Rathbun Lake
- Chariton River
- East Nishnabotna River
- West Nishnabotna River
- Floyd River
- Grand River
- Little Sioux River
- Missouri River
- Big Sioux River
- Mosquito Creek
- Nodaway River
- Platte River
- Rock River
- Soldier River
- Tarkio River

MISSISSIPPI RIVER BASIN

- Cedar River
- Des Moines River, West and East Fork
- Des Moines River, Saylorsville Lake
- Des Moines River
- Red Rock Lake
- Des Moines River
- Fox River
- Iowa River
- Maquoketa River
- Mississippi River
- Raccoon River
- Skunk River
- Turkey River
- Upper Iowa River
- Wapsipinicon River

Flood Frequencies

- South Skunk River - Over 500 Yr. Flood in 2010
 - Previous Peak = 26,000 cfs
 - 2010 Flood = 36,000 cfs (38% increase)
 - Gage has 63 years of record
- Cedar River – 1.4 x 500 yr at Cedar Rapids
 - Gage has 110 years of record
 - Previous Peak – 86,000 cfs
 - 2008 Flood – 150,000 cfs

IOWA

STATE HIGHWAY MAP

Prepared By



Iowa Department
of Transportation

Phone (515) 239-1282

In Cooperation With

United States

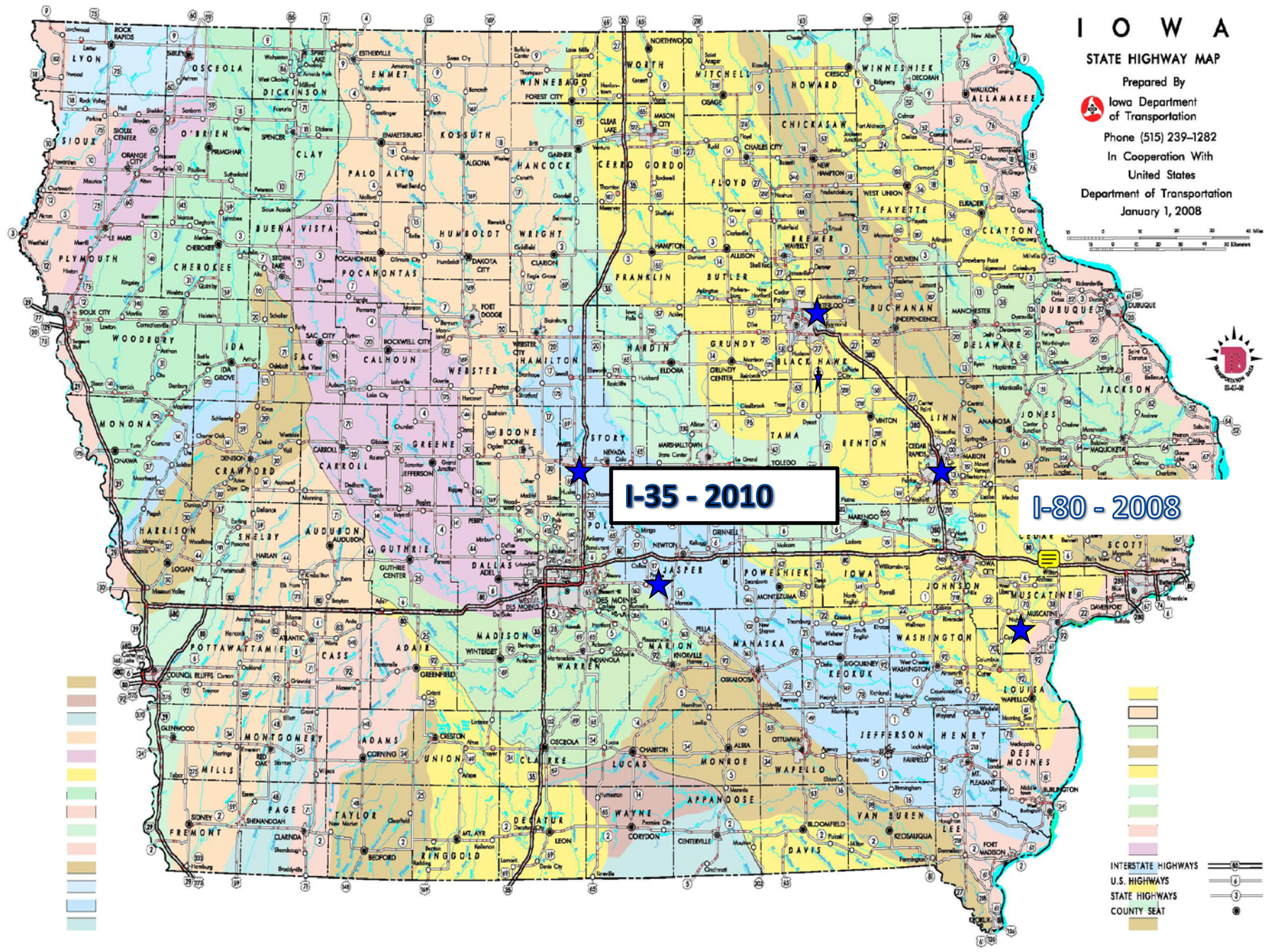
Department of Transportation

January 1, 2008



I-35 - 2010

I-80 - 2008



- INTERSTATE HIGHWAYS
- U.S. HIGHWAYS
- STATE HIGHWAYS
- COUNTY SEAT



Infrastructure Database

- Develop/Correlate Rating Curve at Vulnerable Highway Sites
- Capture Low Road and Low Beam Elevations
- Utilize BridgeWatch to Proactively Protect Traveling Public from Roadway Overtopping

Policy/Design Guidance

- Paradigm Shift
- Assess Changes in Flood/Frequency Relationships
- Design Based on FUTURE Peak Discharges – Not Past Data

QUESTIONS?

Dave Claman, Iowa DOT