Flood Hazards and Flood Risk, the Impact of a Changing Climate

Sally A. McConkey, P.E. CFM, D. WRE.

Illinois State Water Survey

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Topics

- ISWS Coordinated Hazard Assessment and Mapping Program
- Severity and extent of flooding
- Status of regulatory flood hazard mapping and studies
- Urban flooding
- Impacts of climate change on flood hazards
- Resilient Illinois

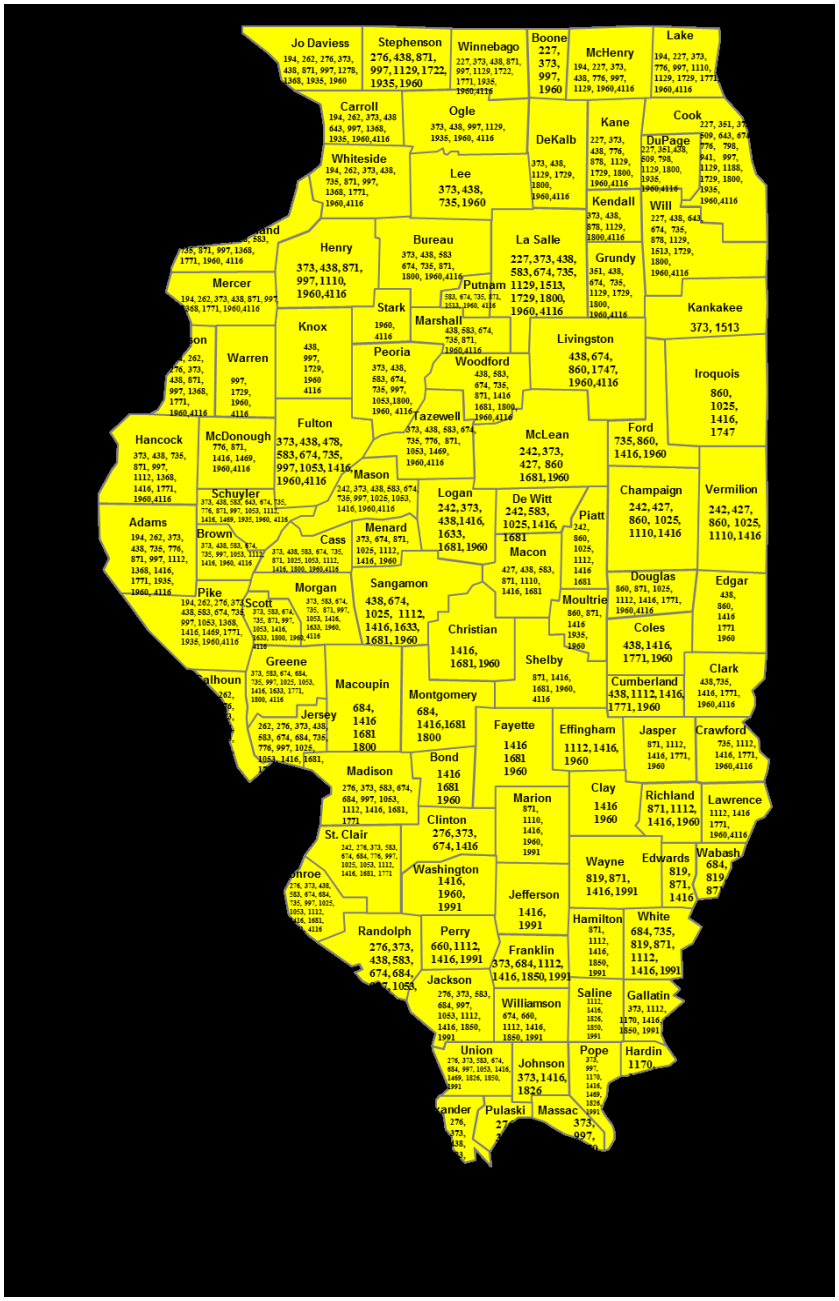
Coordinated Hazard Assessment and Mapping Program (CHAMP)

- Federal Emergency Management Agency (FEMA) Cooperating Technical Partner
  - Develop the regulatory Flood Insurance Rate Maps (FIRMs) for Illinois
  - Perform the hydrologic and hydraulic analyses used to identify flooding impact areas
  - Review proposed changes to FIRMs on behalf of FEMA
  - Conduct public outreach
  - Coordinate with IDNR/OWR and IEMA
- Conduct urban stormwater management analyses
- Perform Flood Risk Assessments
- Research community resilience

Illinois Federal Disaster Declarations since 1965

58 Federal Disaster Declarations since 1965 (60 since 1957)

38 Federal Major Disaster Declarations involved flooding; 12 between 2000 and 2017



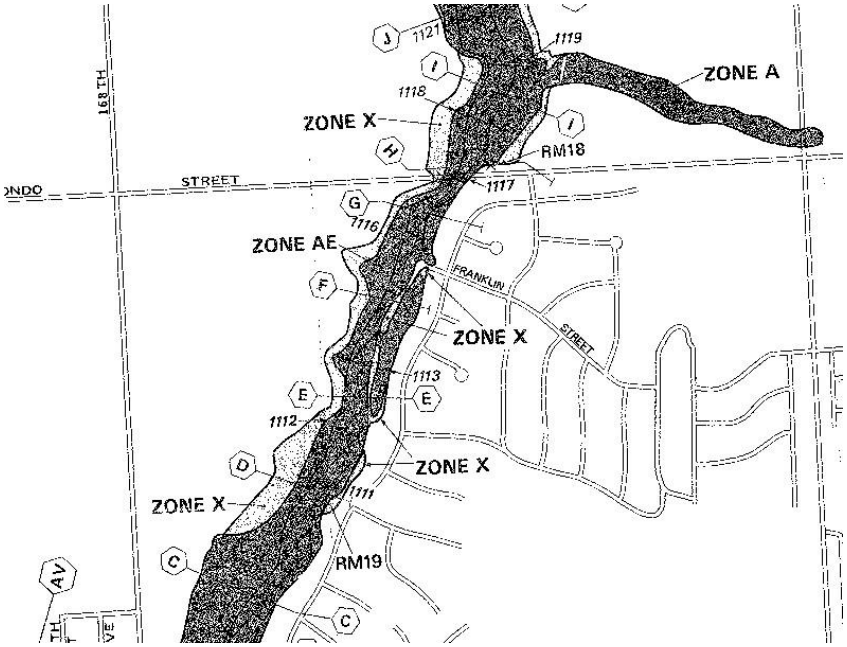
https://www.fema.gov/disasters/grid/state-tribal-government/55?field_disaster_type_term_tid_1=6837&=GO

https://www.illinois.gov/iema/Mitigation/Documents/Plan_IllMitigationPlan.pdf

Flood Hazard Identification-

1% annual chance of inundation

Flood Insurance Rate Map (FIRM) paper format



Digital Flood Insurance Rate Map (DFIRM)

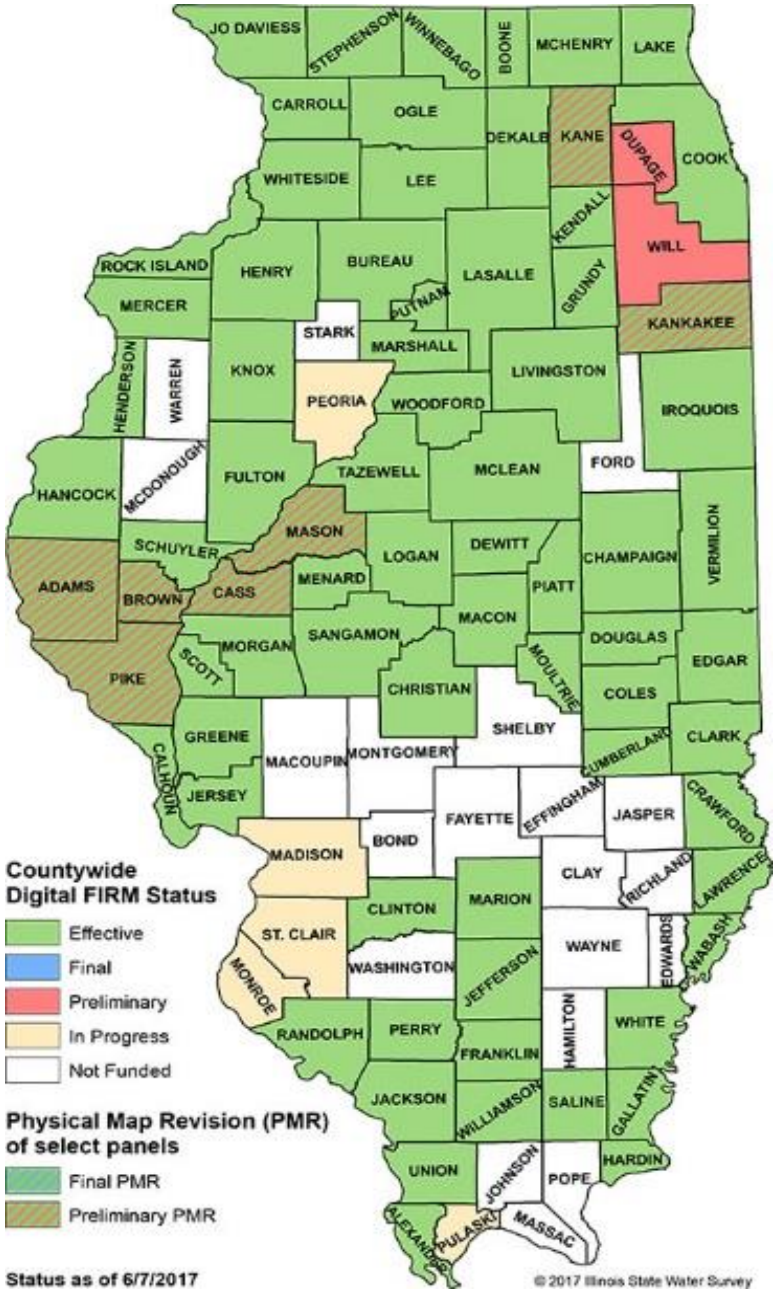
Status of Floodplain Mapping (1% annual chance flood)

25 Counties' effective Flood Insurance Rate Maps (FIRMs) are paper format based on data 20 or more years old

- 5 funded for updated digital mapping (Peoria, Madison, Monroe, St. Clair, and Pulaski)
- 2 funded for new flood studies (Ford & Warren)
- 2 proposed for FFY2017 funding for study updates and digital mapping (Effingham & Clay)

- 16 counties with no updates scheduled

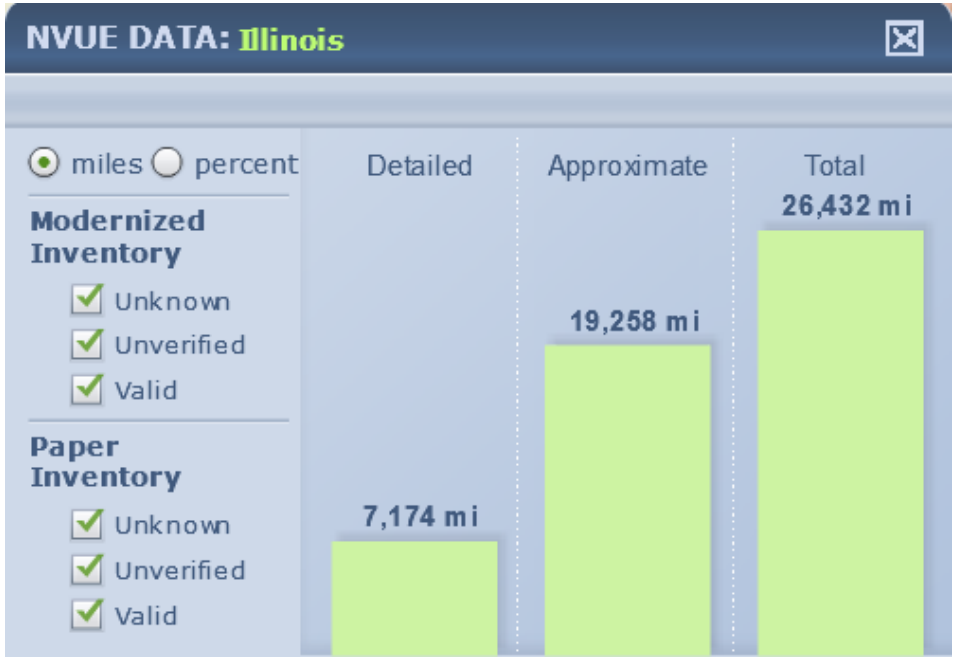
Effective Digital FIRMs in 77 counties have limited updated flood data, most are based on out of date study data

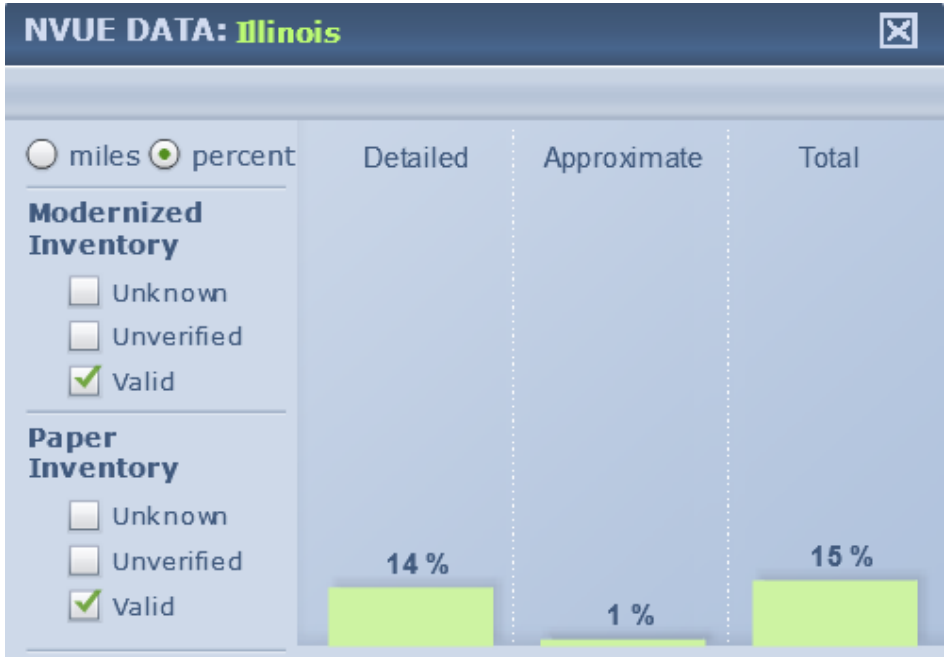


Streams with 1% annual chance floodplain mapped

Only 21% of mapped stream miles are based on detailed engineering analyses

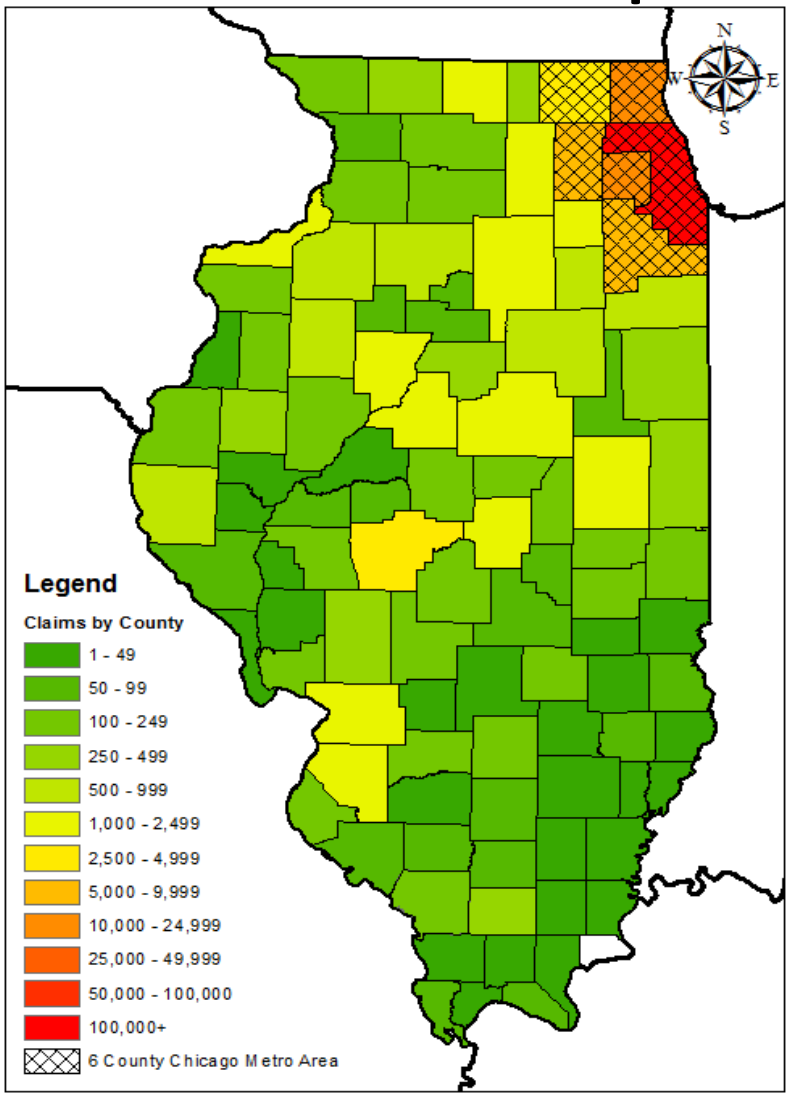
Only 15% of all mapped stream miles are considered valid



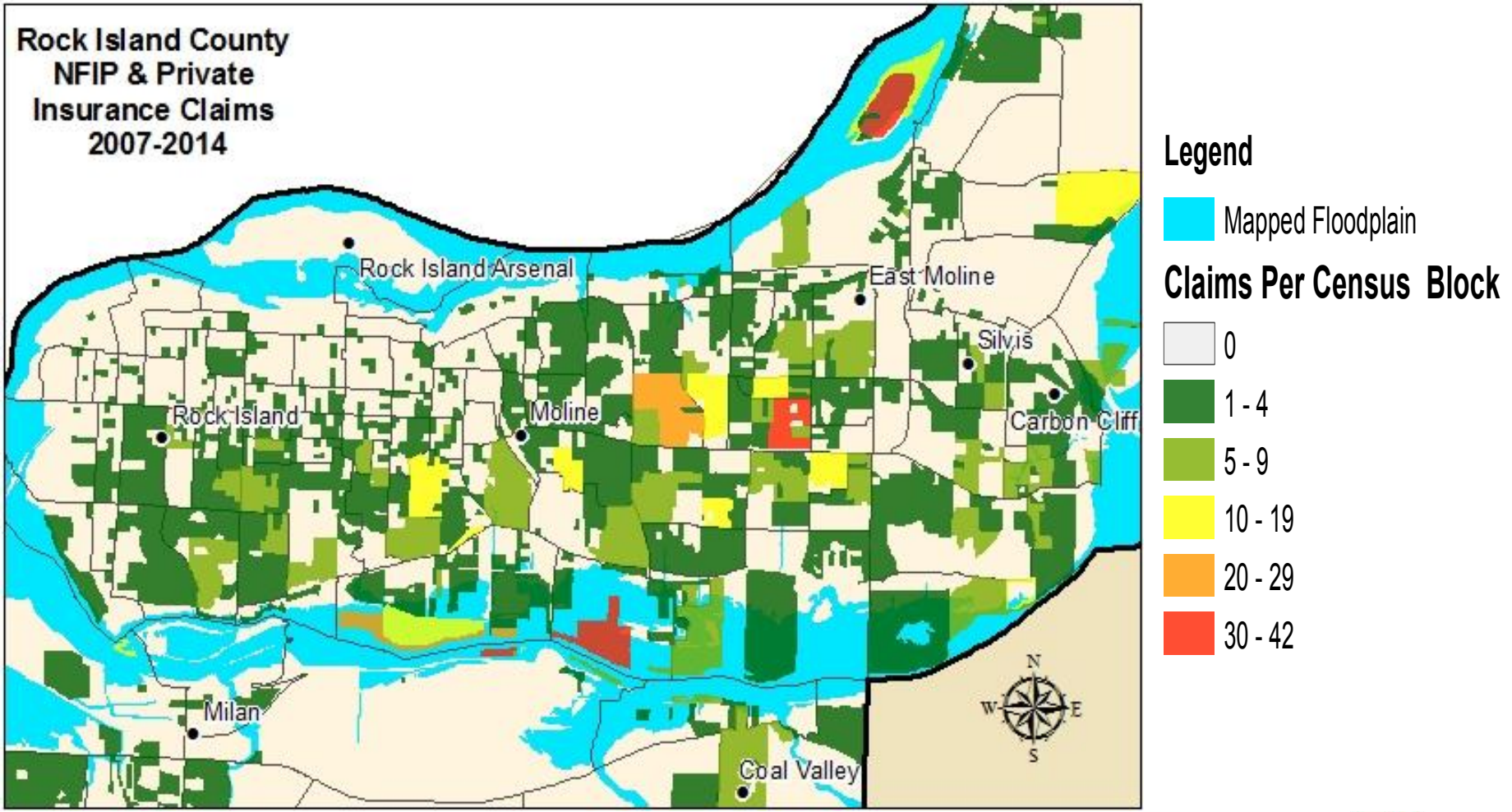


Urban Flooding Awareness Act Report

- **$2.319 billion in documented damages between 2007 and 2014**
- **Map shows number of claims per county**
- **$1,240 billion were private claims that typically represent basement flooding and sewer backup.**
- **Although the largest percentage of insurance claims is from northeastern Illinois, urban flood damages and problems occur statewide in urban areas.**



Increasingly flooding damage is occurring outside the mapped floodplain



Flood hazard identification and Infrastructure Design

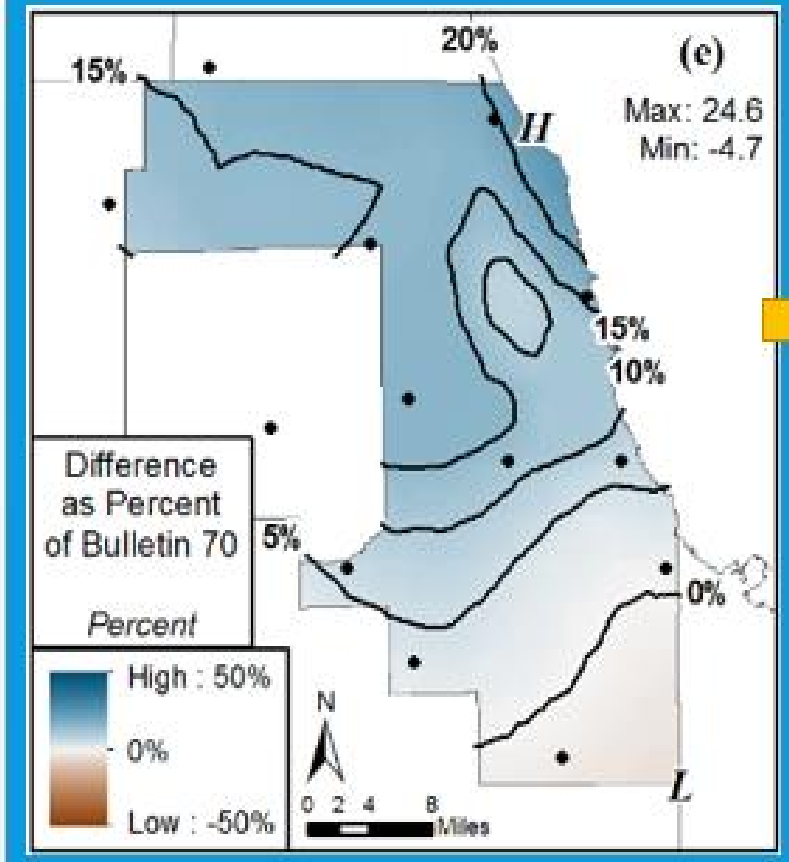
(design storm approach examples)

- Floodplains are identified by modeling the impact of statistically extreme rainfall events; e.g. the expected 100-year rainfall (1% annual chance of occurrence).
- Stream gage data is used when available.
- Storm sewers are typically designed to convey a rainfall that occurs on average once in 10 years, the 10-year rainfall (10% annual chance of occurrence)
- New bridge construction is designed for the 100-year event
- Older bridges may only have a design capacity for a 15-year event

Impact of Climate Change

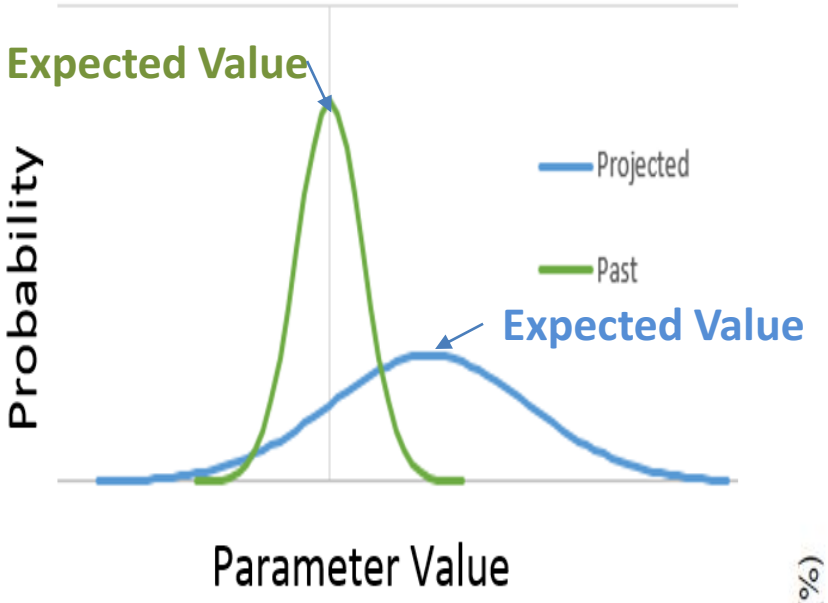
		Total inches of rain for event*			
		NWS Technical Paper 40 (1961)	*ISWS Bulletin 70 (1989)*	*Mid Century - 2046-2065 Markus, et. al. (2016)*	*Late Century – 2081-2100 Markus, et. al. (2016)*
	Design Storm:				
Riverine floodplain / Stormwater Detention	*100-year, 24 hour*	5.75	7.58	8.00	8.75
Storm sewer	*10-year, 2 hour*	2.37	2.64	NA**	NA**
*Near O'Hare Airport in Cook County					
** 10-year, 24 hour expected 20 to 25% increase					

Difference in future precipitation under A2 climate scenario 2046-2065

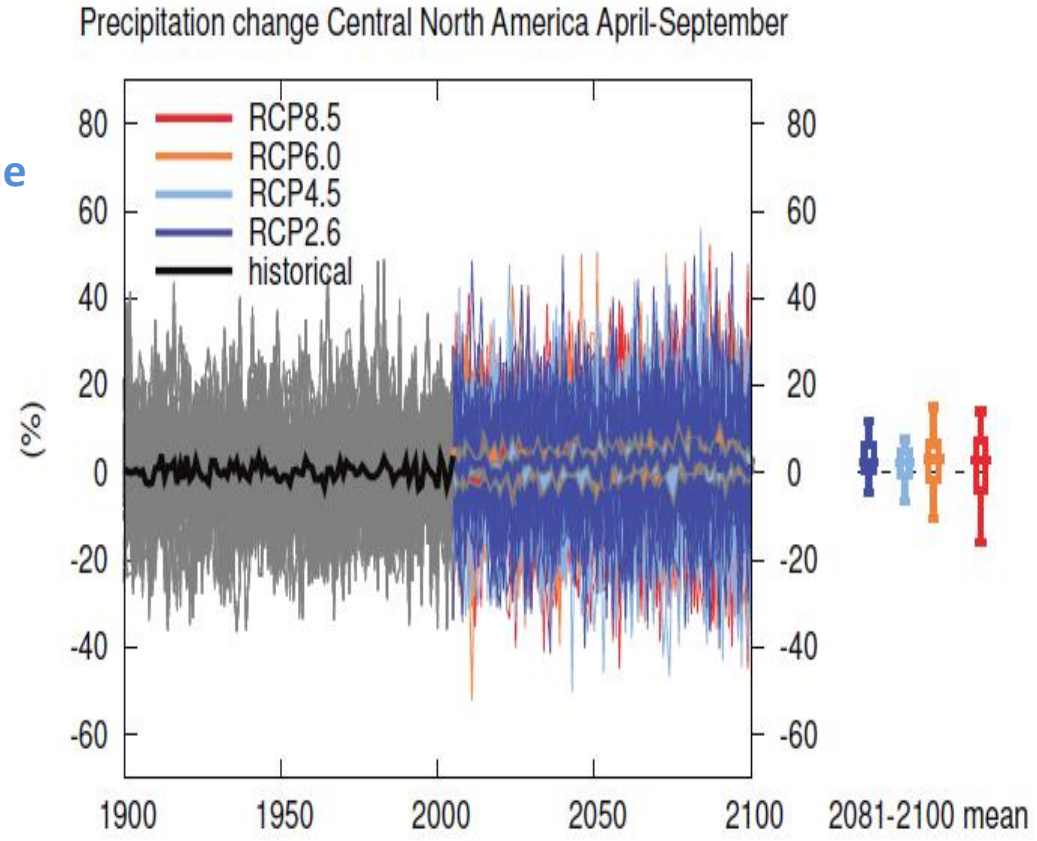


Projected changes in the 1% Annual Chance (100-year) Floodplain from present to Mid-Century (2046-2065) and to Late-Century (2081-2100).

Future Uncertainty & Risk Management



Average Precipitation Change for North America (IPCC, 2013)



Resilience in Practice

- Illinois Statutes recognize the importance of water management
- Illinois higher regulatory standards, floodplain fill/ encroachment is limited to a 0.1 foot rise compared to the national standard of 1.0 foot allowable rise
- Regulation of construction in stream floodway
- Training and support of Local Floodplain Managers
- Communities are encouraged to adopt even higher standards (Community Rating System)
- Mitigation is a high priority, IDNR/OWR and DCEO providing the local match (75% Federal: 25% Local) over 5500 structures have been purchased and no longer at risk.

Illinois is ranked #1 in the nation for:

1. Overall % reduction of Rep Loss properties.
2. Fewest % of flood insurance claims on post-FIRM (newer) structures.
3. The most NFIP suspensions for compliance (75% of the nation's total)!

Conclusions

- Flooding is leading natural disaster in Illinois
- Flooding is expected to increase in frequency and magnitude due to climate change
- The extent of future flood hazards need to be identified for strategic planning
- Floodplain management standards above the minimum Federal requirements build resilience
- Aggressive mitigation actions such as buying out at-risk structures reduces flood risk

Resilient Future

- Update rainfall assessment using climate models to identify precipitation patterns and design storms
- Use future design storms for floodplain and stormwater management planning and design
- Use risk based assessment for major projects
- Apply higher standards for new and replacement infrastructure
- Disseminate actionable information to local officials
- Invest in mitigation
- Retreat from floodplains