More Rain in Intense Storms: What Cities and NOAA Can Do About It

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Topics

• Focus on Atlas 14 first
• Full-system H & H models
• Benefits and challenges
• Conclusions & recommendations
We use precip frequencies for much of our stormwater work – **COMPUTER MODELS**

- Catch basins and pipes are designed to handle the 5 – 10 year storms

- We base structure elevations on the 100-year high water level – plus freeboard

- We base emergency overflows on the Maximum Probable Storm
Precipitation Frequency Estimates
Precipitation Frequency Estimates

- The basis for our storm amounts was Technical Paper 40 (TP-40) produced in 1961.
- This was replaced by Atlas 14, in 2013.
Precipitation Frequency Estimates
Precipitation Frequency Estimates

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)

<table>
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<th>Duration (min)</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>200</th>
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PDS-based depth-duration-frequency (DDF) curves
Coordinates: 44.8831, -93.2289

Average recurrence interval (years):
- 1
- 2
- 5
- 10
- 50
- 100
- 200
- 500
- 1000

Graph showing the relationship between precipitation depth and duration with a 90% confidence interval.
Precipitation Frequency Estimates

Significant changes with Atlas 14

• The 100-year, 24-hour storm at MSP went from 6” to 7.5”

• The Dust Bowl years were less of a factor

• We had more weather stations and new statistical methods

• **A trend toward more of our rain coming in intense storms**
Atlas 14 reflects Climate Change

- Atlas 14 moves us in the same direction as climate change projections
- Atlas 14 is based entirely on historical weather data
- We avoid projections with uncertainty
- We avoid the political “baggage” of climate change
- Engineering ethics – best data
Full-system H & H Models

- H & H = hydrology and hydraulics
Full-system H & H Models

- Modeling well-understood and well-behaved physical behavior of water
- Models can handle an entire city system or a single problem area
- Reasonable cost – not trivial
- All consultants do this work
- Basic tool to design and understand your city’s stormwater system
Full-system H & H Models

- How many cities have a full-system H & H model of their entire system?
- How many cities have updated their full-system model to the Atlas 14 storms?
- Many cities are using Atlas 14 for projects and looking at specific problem areas
Benefits of an updated city-wide model

- Identify problem areas – before they are catastrophes
  - Higher water levels – imperiled structures
  - More emergency overflows
  - Higher and faster flows
  - Surface flooding
- **STRESS TEST** for city stormwater systems
Full-system H & H Models

Challenges

• Identified problem areas will be expensive to fix
• Some areas fixed sooner, some later
• Structures identified as imperiled because of higher 100-year water levels – public & private
• Mismatch with FEMA and floodplain mapping
• Larger stormwater BMPs
Worth noting....

• This updating needs to be done in anticipation of more intense storms in the future – climate change

• Basing it on Atlas 14 is a great first step

• If you do it once, it will be easier to update in the future

• Engineering ethics
Conclusions & Recommendations

• In city ordinances and guidance, replace “100-year storm” with a number – provide the reference

• Get a full-system H & H model for your city

• Update your model to Atlas 14 – city-wide

• Lay the groundwork for future updates with increased design storms
Conclusions & Recommendations

• Let’s consider a state-wide funding and incentive program to help cities get and/or update their full-system H & H models

• Let’s consider national advocacy to get Atlas 14 updates funded and regularized

• These updates need to occur more frequently than every 50 years
Conclusions & Recommendations

- National Atlas 14 updates
  - Less expensive
  - More accurate
  - Reasonable schedule
Thanks for your attention

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