

# Identifying Raritan River Basin Bridges Vulnerable to Hydraulic Failure

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**RUTGERS**  
THE STATE UNIVERSITY  
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**C2R2**



Coastal Climate Risk  
and Resilience Program

# Raritan River Basin Bridges and Hydraulic Hazards



Image Sources: Left: CBS New York, 2011. Right: Reuters, 2011



New Jersey Total	6737 bridges	100%
Raritan River Basin	1267 bridges	18.8%
RRB Over Waterway	787 bridges	11.6%

## Why Waterway Bridges?

- Connective critical infrastructure
- Expensive and long-term replacement cost
- Over 50% of bridge failures are hydraulic
- Exposed to climate change: sea level rise, heavy precipitation, and stormwater runoff

# Study Methodology

1. Inductive approach to identify bridges vulnerable to hydraulic failure
  - What can indicate vulnerability? Failure mechanisms?
2. Compare **current bridges** vs. **hydraulically failed bridges** (1994-2017)
  - New York State Department of Transportation Bridge Failure Data cross-referenced to National Bridge Inventory (NBI) year 1994
  - Statistically significant differences, distributions, and characteristics between current and failed populations
3. Use findings to **identify vulnerable bridges** in the Raritan River Basin
  - 111 'high vulnerability' bridges out of 787 over waterways

## Mid-Atlantic 'Failed Bridge' Population

National  
Bridge  
Inventory  
1994  
(PA, NY, VA)

NYSDOT  
Bridge  
Failure  
Database  
(Hydraulic)

## 'High Vulnerability' Raritan River Basin Bridges

National  
Bridge  
Inventory  
2017

Statistically  
Significant  
Differences

# Hydraulic Failure Characteristics & Results

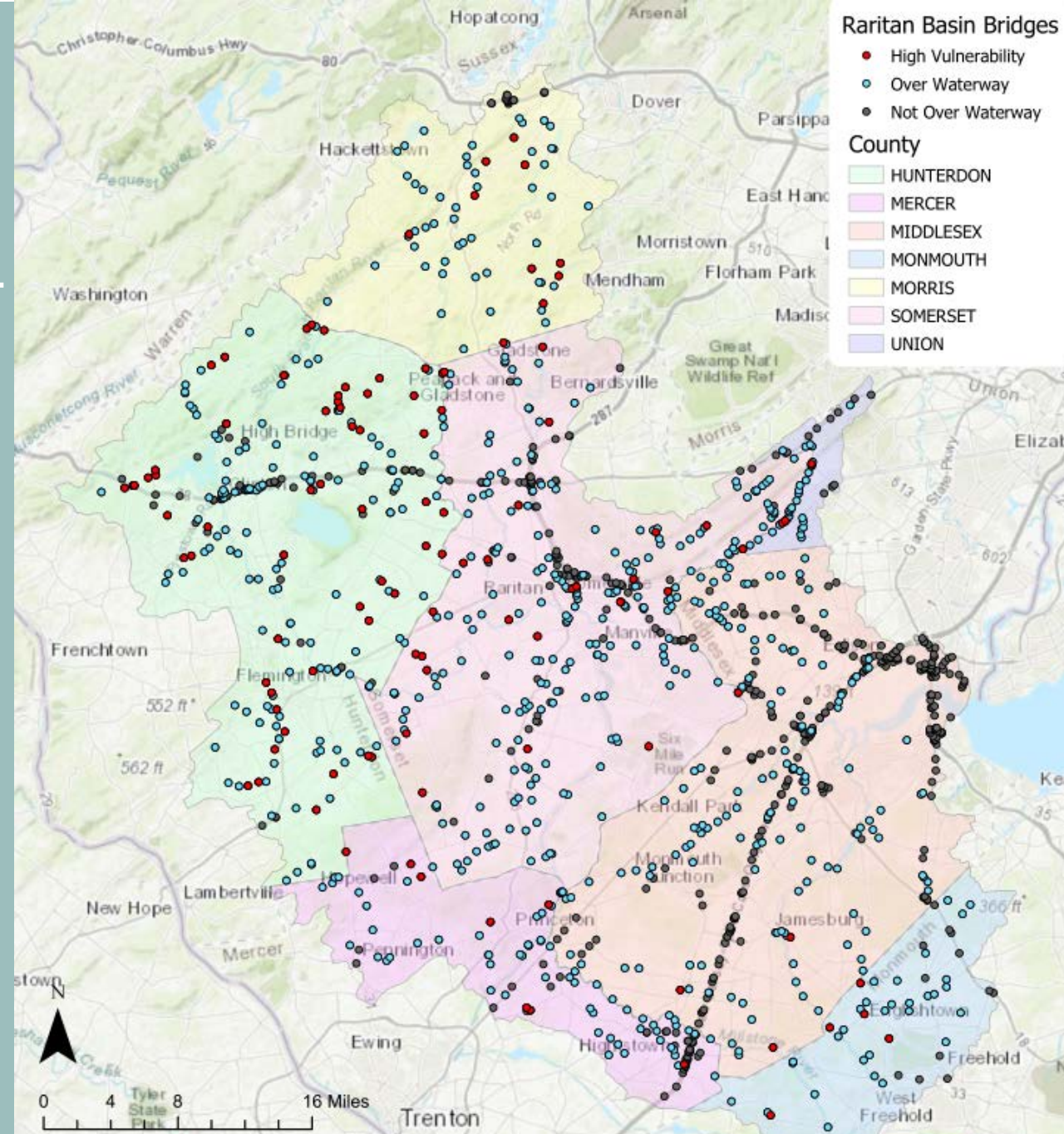
Age: older, outdated design load and safety features

Geometry: short single span, narrow thin deck

Consequences: lower traffic, longer detour lengths



Engineers, planners, and emergency management can use search tool for replacement, protection, retrofits, or contingency emergency plans for hydraulic events



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community