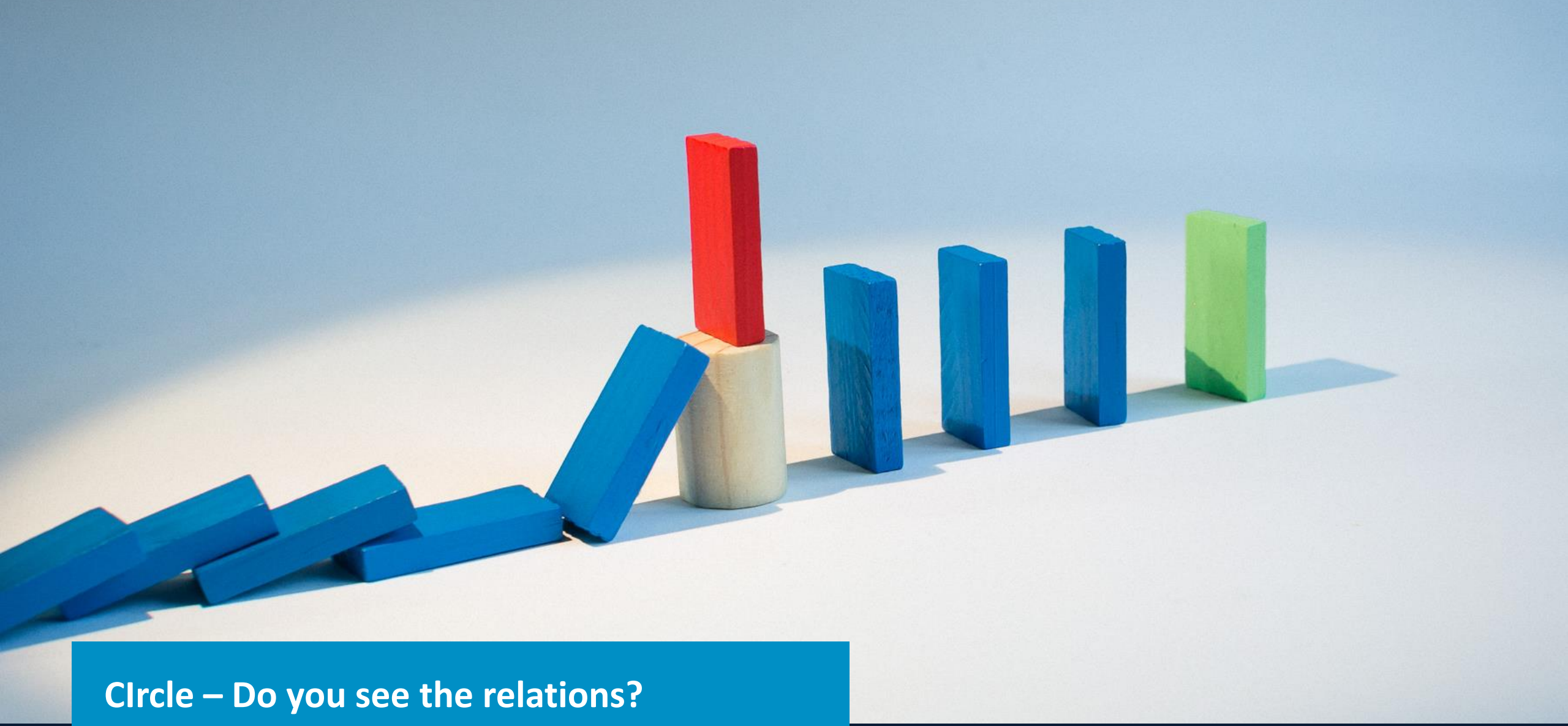

CIrcle – Do you see the relations?

Understanding Cascading Effects in Critical Infrastructures

Critical Infrastructures

“[…] Critical infrastructure provides the essential services [for our] society and serve as the backbone of our nation's economy, security, and health.

We know it as the power we use in our homes, the water we drink, the transportation that moves us, the stores we shop in, and the communication systems we rely on to stay in touch with friends and family.”

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Challenge: Aging Infrastructure

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Challenge: Changing Climate

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Challenge: Complex Systems

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Amsterdam Blackout 2015

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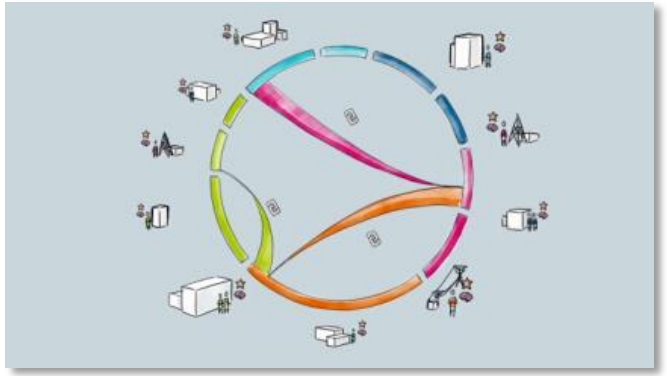
CIrcle Concept

1. Stakeholder Participation
2. Collaborative Mapping
3. Visualization



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Case Studies

Case Study South-Florida

- Project: **Critical Infrastructure and Flood Resilience in South-Florida (CIFRe)**
- Partners: **Broward County, South-Florida Water Management District, Deltares USA**

- Goal: **better understand dependencies between critical infrastructures**
  - **Improve collaboration between organizations**
  - **Identify measures to increase resilience**

“CIrcle has provided a common means for visualizing, assessing and communicating exposures, planning, and investment needs”

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Recent Events in South Florida

- Hurricane Sandy (2012)
  - Fatalities: 233 total
  - Damage: $68.7 billion (2012 USD)
- Hurricane Irma (2017)
  - Fatalities: 52 direct, 82 indirect
  - Damage: $64.76 billion (2017 USD)

“The recent storm and flood events show us, how vulnerable our society is.”

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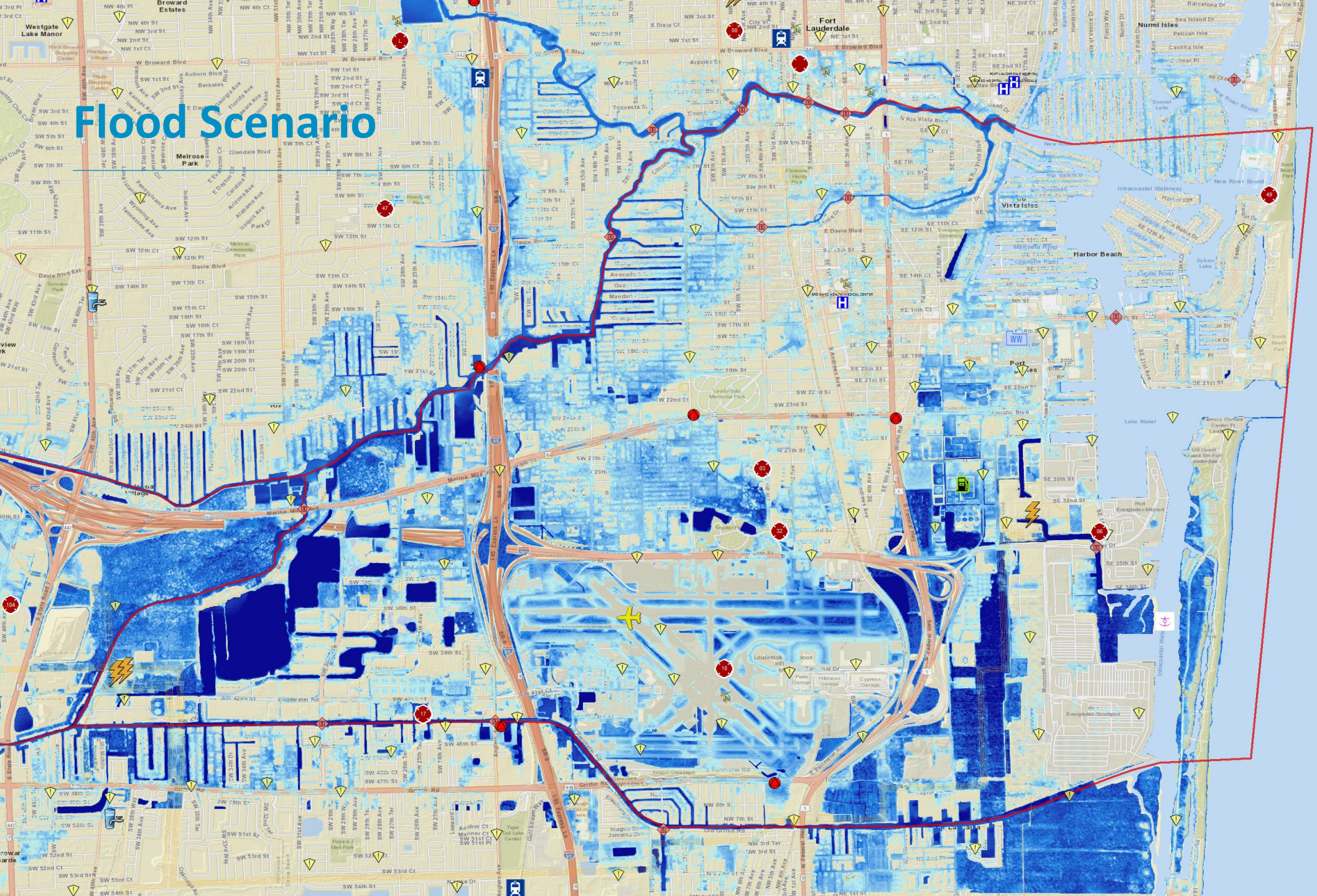
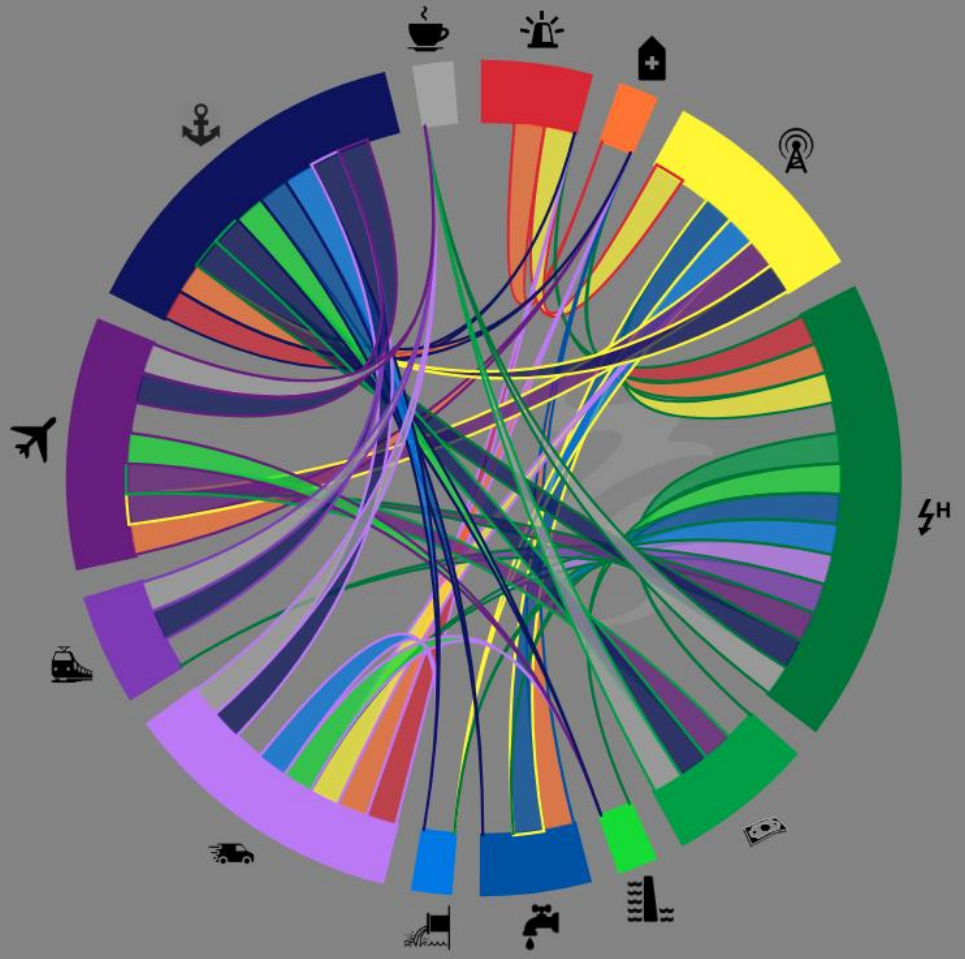
Collaborative Mapping

Flood Scenario



Circle – Do you see the relations?

- Emergency Services
- Healthcare and Public Health
- Communications and IT
- Electricity
- Financial Services
- Storm Water System
- Drinking Water
- Wastewater
- Main Roads and Tunnels
- Railroad
- Airport
- Port and fuel storage
- Commercial Facilities



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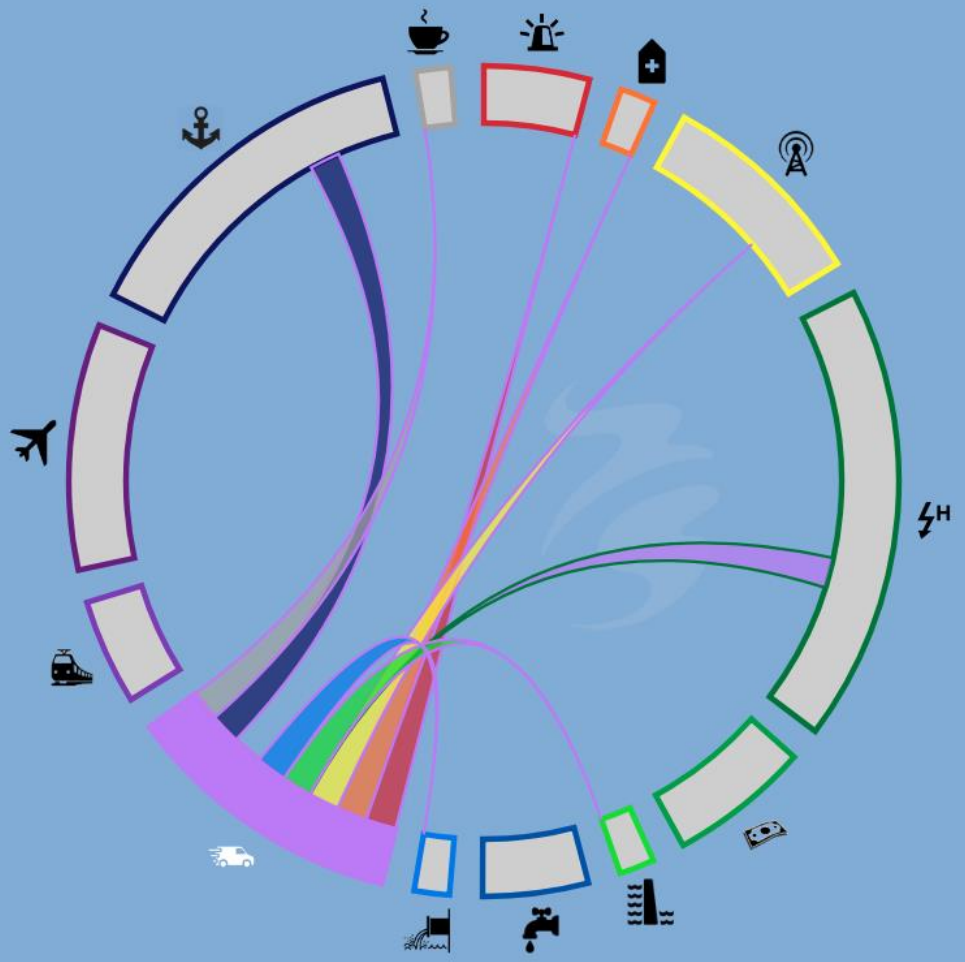
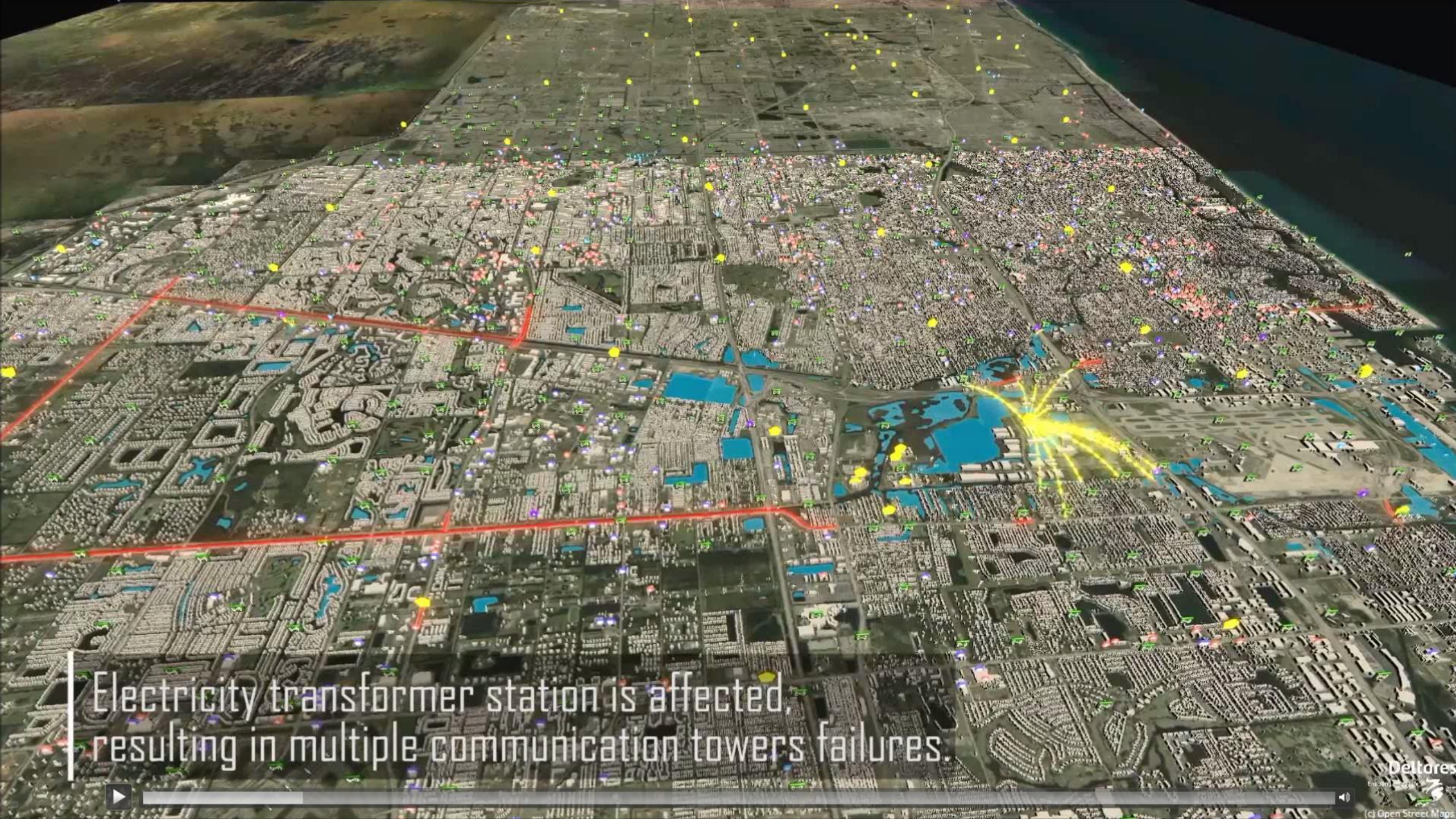
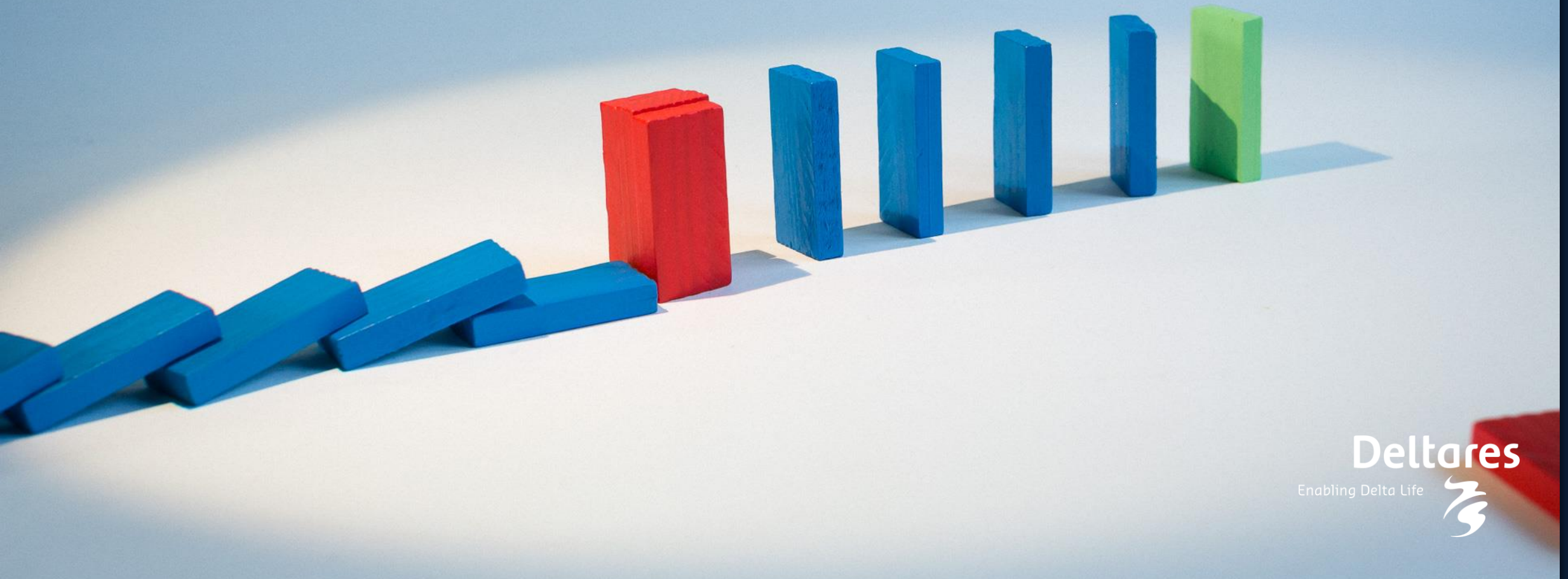



Electricity transformer station is affected,
resulting in multiple communication towers failures.
Deltares
(c) Open Street Map

Create Resilient Networks



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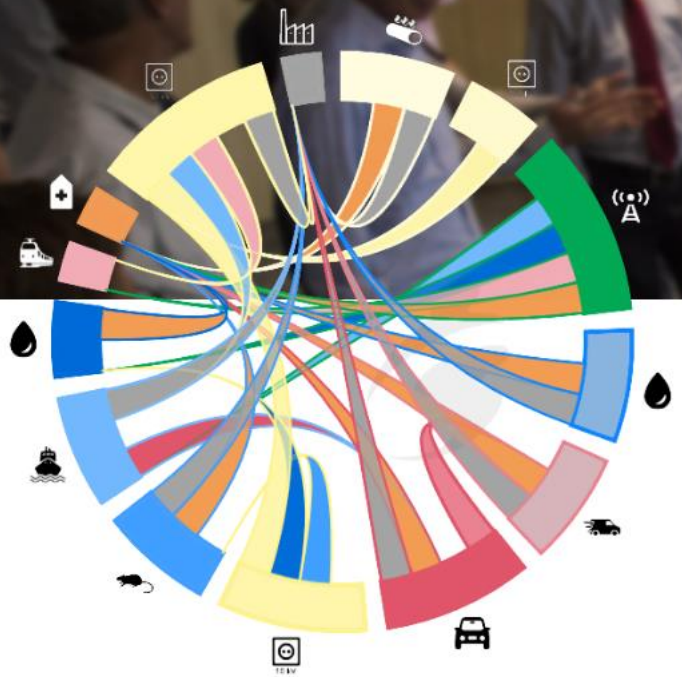

Discover more

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CIrcle online tool: http://circle.deltares.org

Augmented Reality

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Augmented Reality

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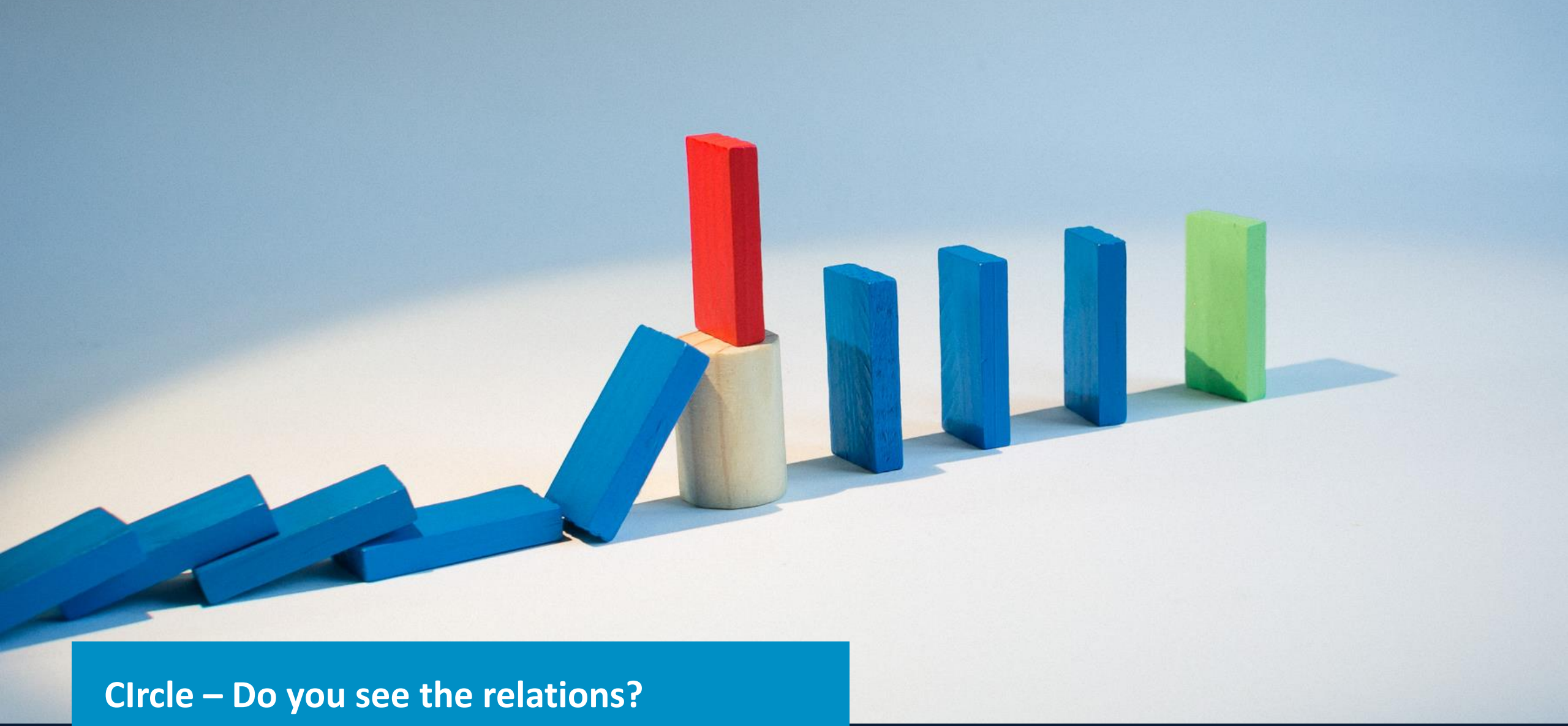

CIrcle – Do you see the relations?

Understanding Cascading Effects in Critical Infrastructures