

October 2025

THE TECHNICAL IMPLICATIONS OF COMMUNICATING AROUND WATER INFRASTRUCTURE

Kasey Faust

Associate Professor & John A. Focht Centennial Teaching Fellow in Civil Engineering, The University of Texas at Austin



About me...

Education

BSCE, University of Washington, June 2009

MSCE, Purdue University, December 2010

MSIE, Purdue University, May 2013

PhD, Purdue University, May 2015

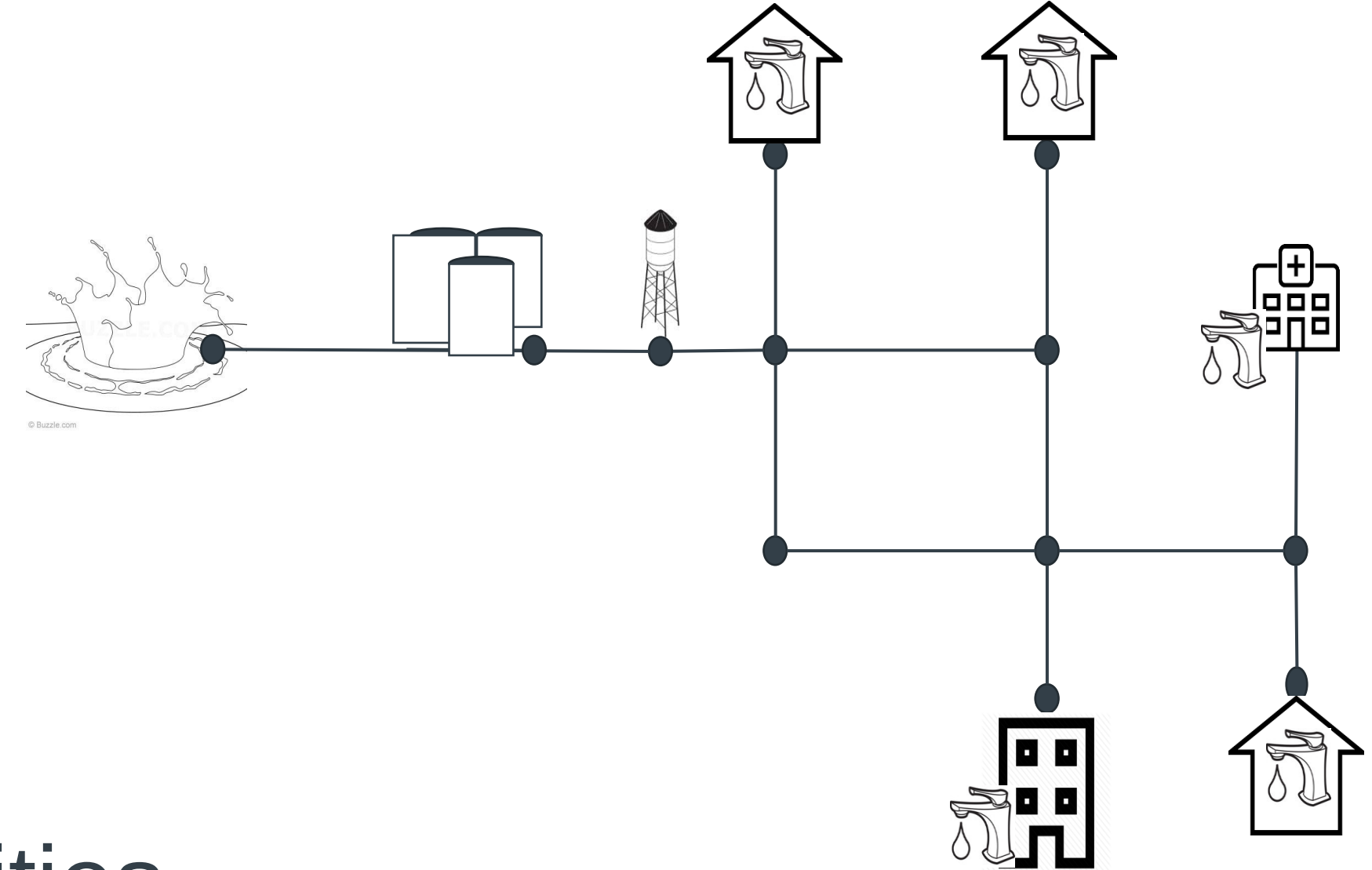
Teaching

- Project management and economics (undergraduate)
- Sustainable systems engineering (undergraduate)
- Quantitative methods for project analysis (graduate)
- Urban systems engineering (graduate)

A Few Fun Facts

- Grew up in Anchorage, Alaska
- Hobbies - outdoors- rafting, four-wheeling, fishing, camping, hiking...
- Love traveling
- Working with people – my passion





Technical capabilities

Environmental considerations

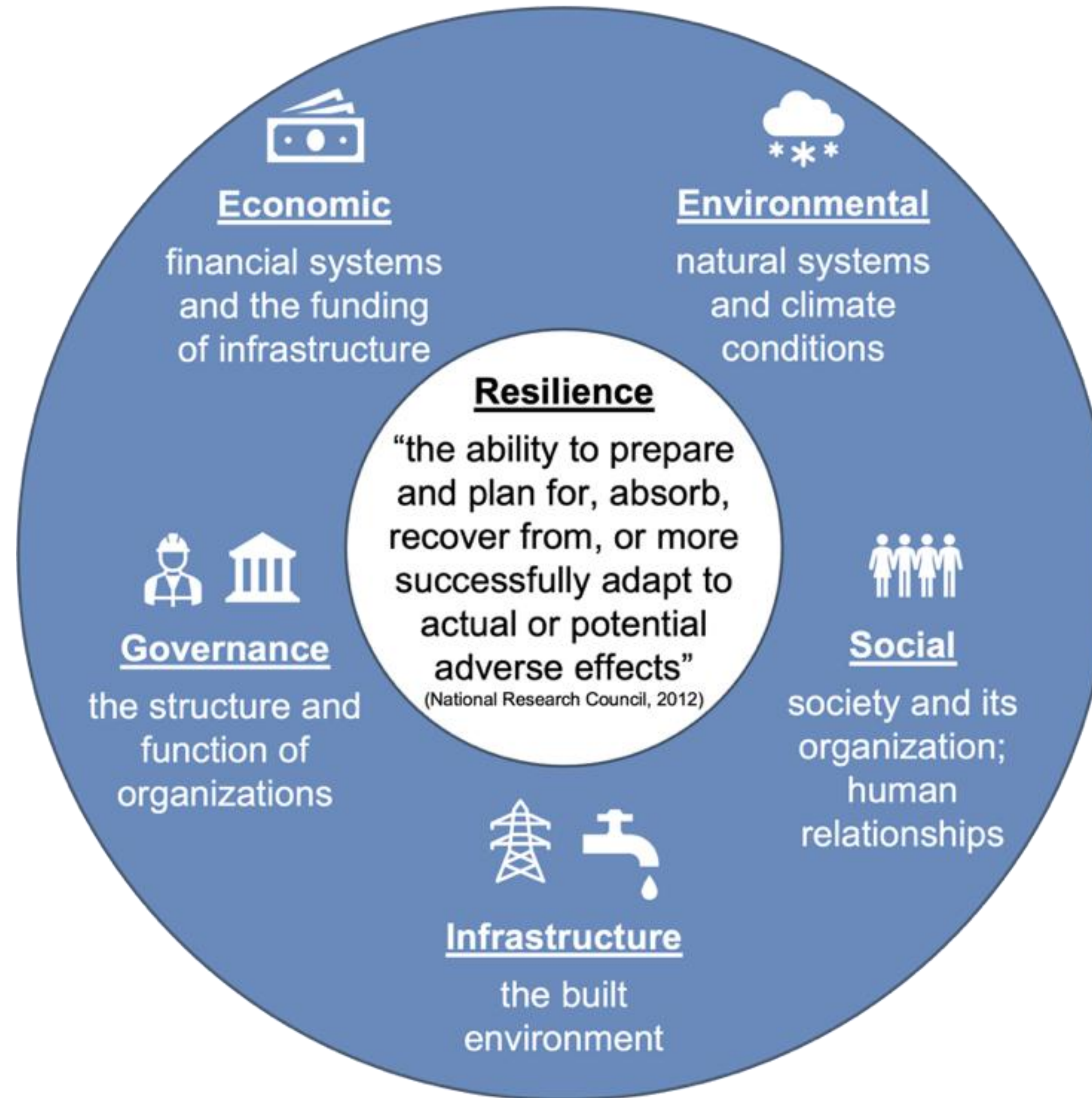
Formal regulatory environment

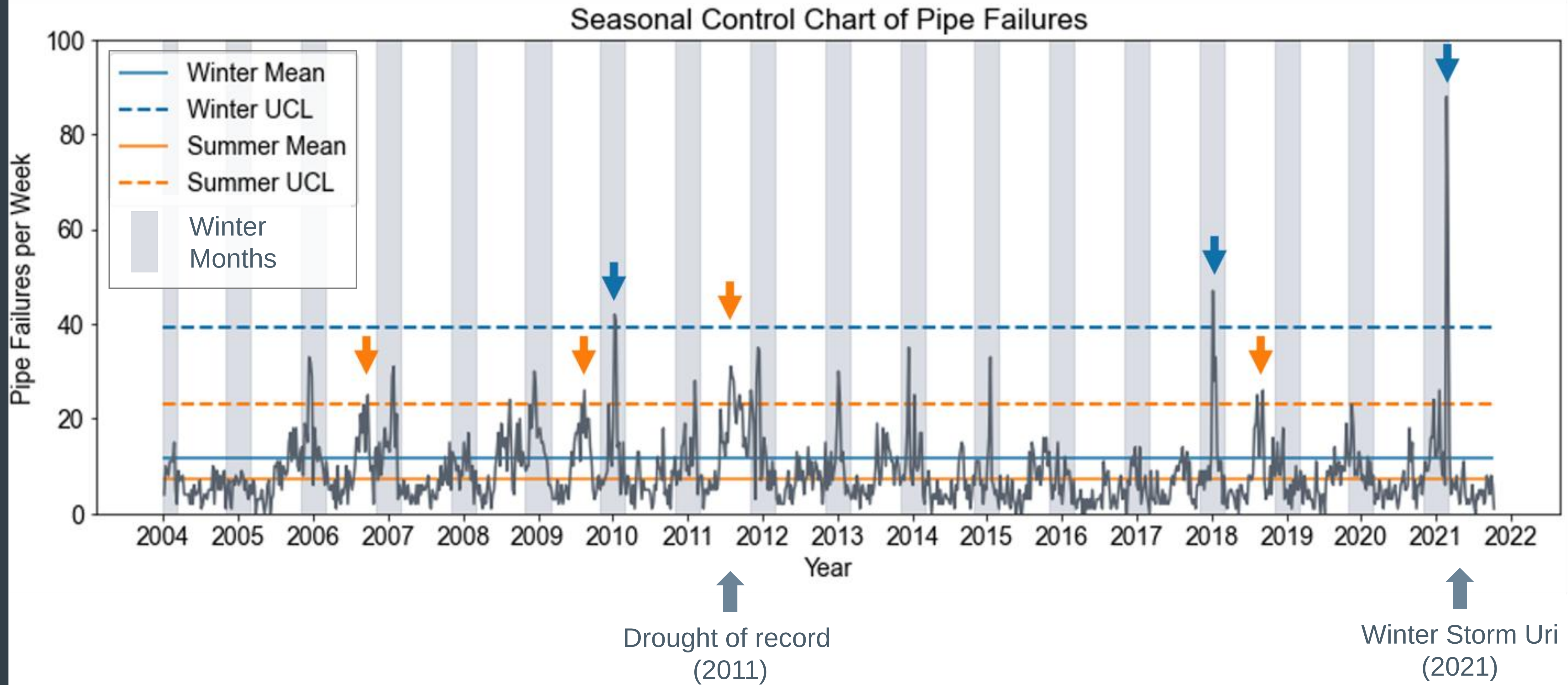
Economic

Human-infrastructure interactions/ socio-cultural operating environment

Five Dimensions of Resilience

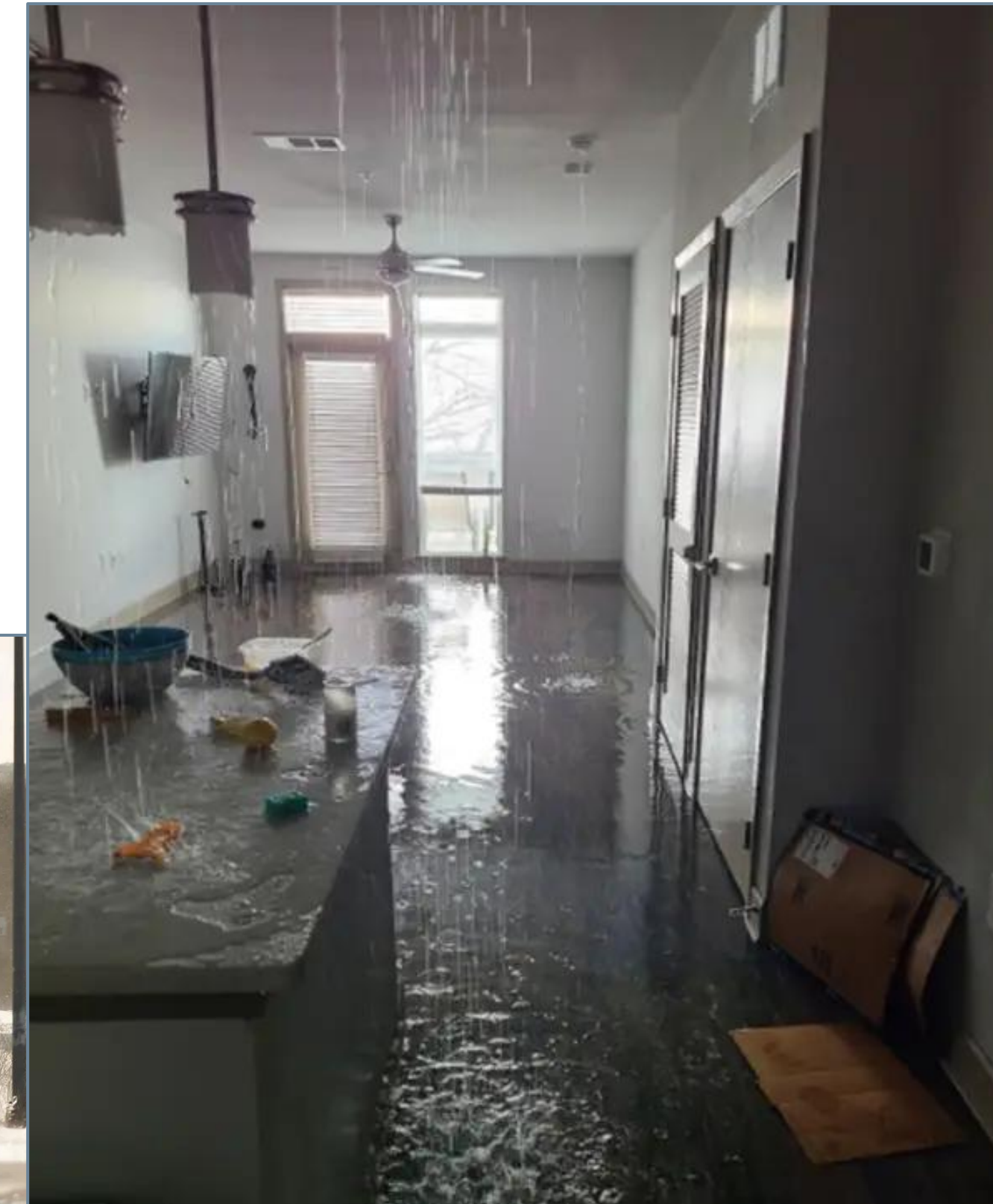
(Opdyke et al 2017)





Conversational Context: Winter Storm Uri

- February 2021
- Heavy ice, snow, and over five days of subfreezing temperatures
- Cascading failures in energy system led to water system failures (Busby et al. 2021, Glazer et al. 2021)
- 49% of surveyed residents experienced water outages (Watson et al. 2021)
- 40% of community water systems issued boil water notices (TCEQ 2021)



Andrew Reimers

The Texas Tribune 2021



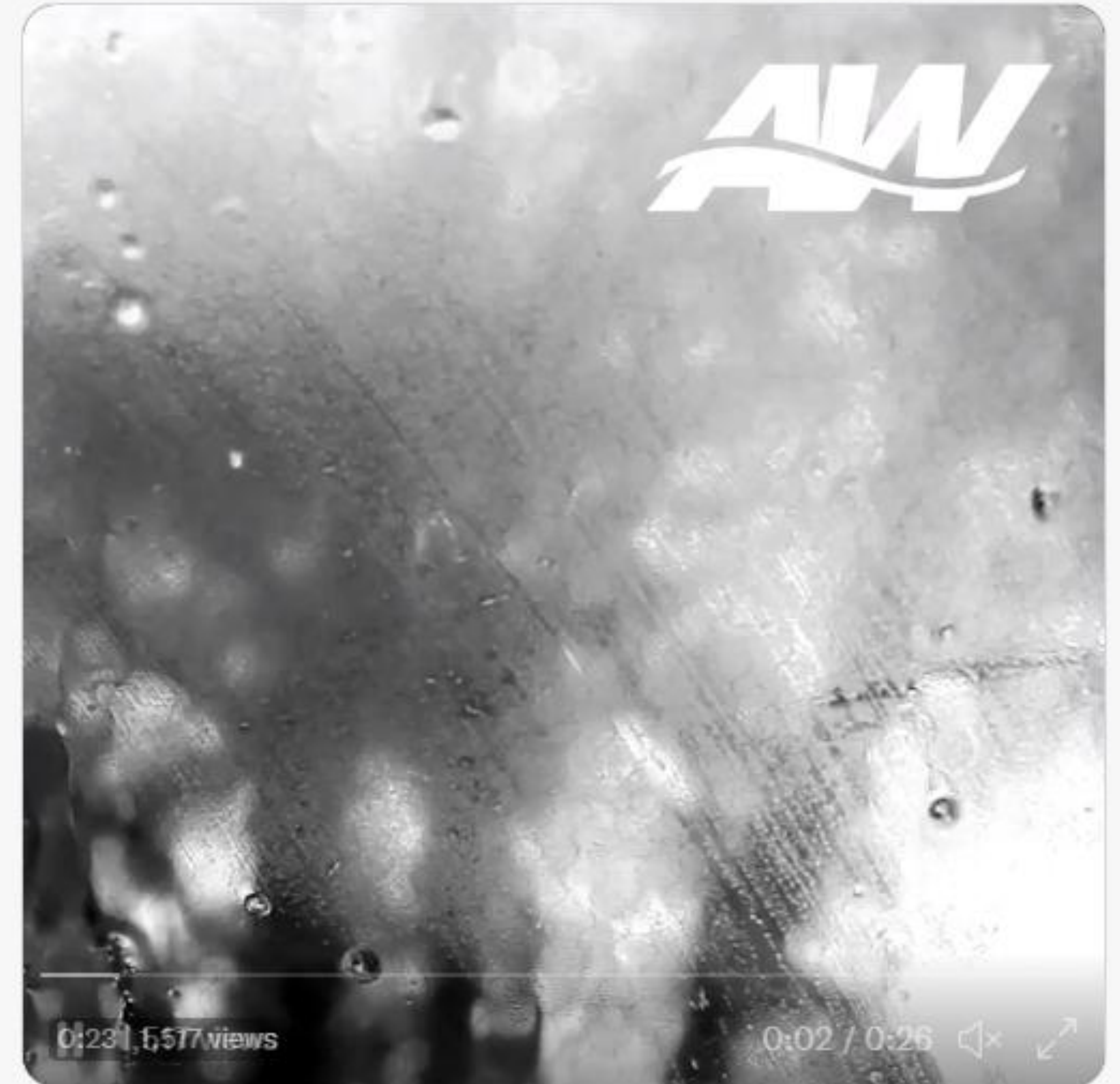
Austin Water  @AustinWater · Feb 13, 2021

Prevent property damage during freezing weather. Know where your property owner's cut-off valve is located&how to use it. Apply oil (ex: WD-40) to the cut-off valve before operating to prevent breakage. The valve should be adjacent to the water meter box. austinwater.org



Austin Water  @AustinWater · Feb 14, 2021

Renters&tenants may be responsible for damage caused by broken water pipes during severe weather conditions. Residents should contact their property management/landlord to locate the property owner's cut-off valve in the event of a pipe breakage. More @ austinwater.org





Austin Water ✓ @AustinWater · Feb 15, 2021

Please help us minimize the impact and strain on our water/electric system by delaying the use of large appliances such as washing machines/dishwashers. Help conserve electricity/water during this extreme weather event. Updates, tips and more at austintexas.gov/article/freezi...



6

35

47



Austin Water ✓ @AustinWater · Feb 17, 2021

To avoid a citywide boil water notice, impacts to fire protection, or widespread lack of water service, Austin Water is immediately requiring mandatory conservation measures and limiting water use to essential needs. More @ austintexas.gov/boilh2o



Austin Water ✓ @AustinWater · Feb 18, 2021

Our water system has experienced rapid changes due to extreme weather. Water use surpassed typical usage by 250% over the past 24 hrs due to dripping faucets/pipe leaks/line breaks from freezing temps causing pressure & storage to significantly drop. Conserve water when you can.

148

134

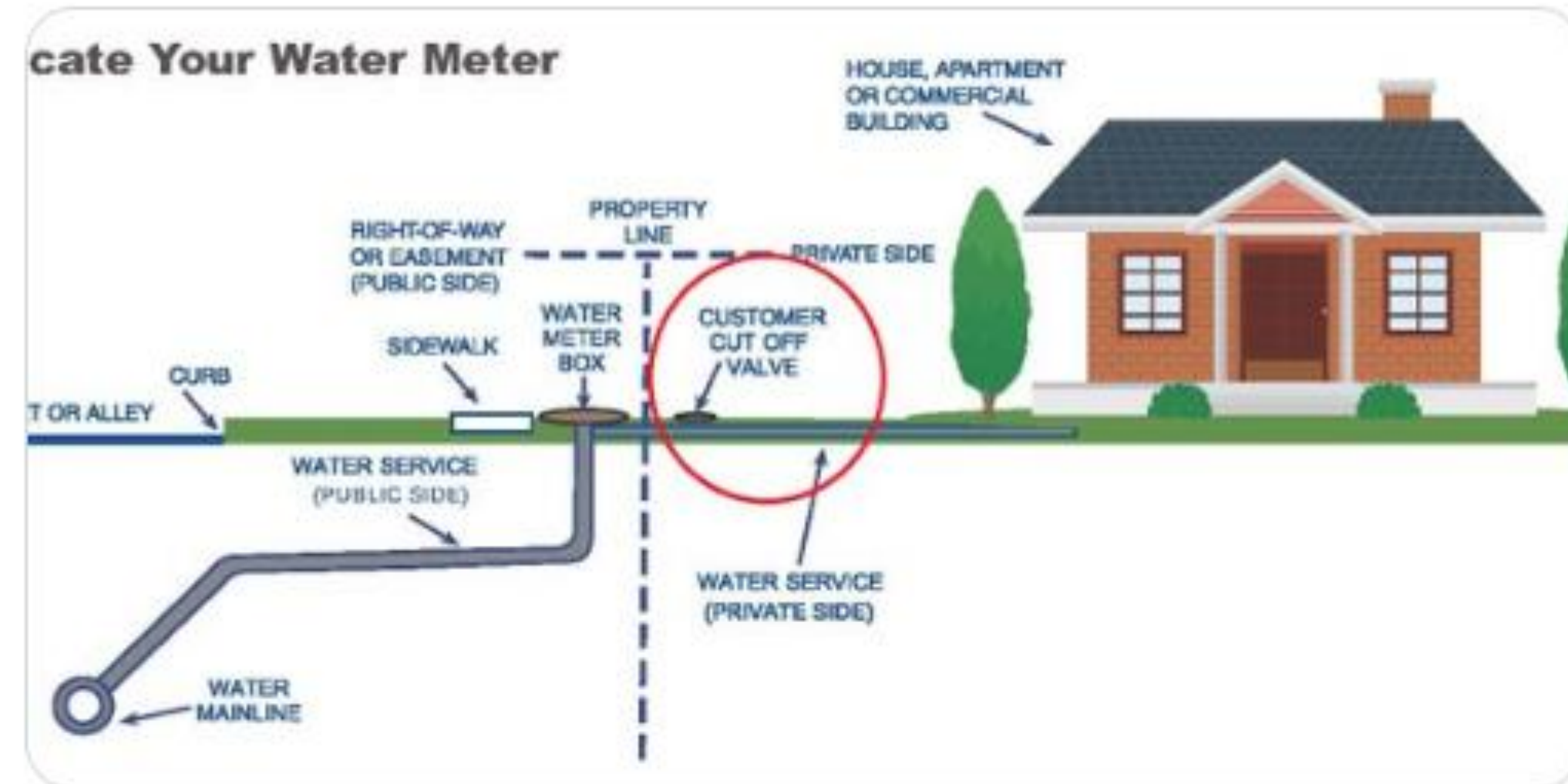
266





Austin Water @AustinWater · Feb 16, 2021

1. There are NO plans to disrupt water service. Our plants are operating normally. 2. Emergency Dispatch Crews (512-972-1000) are responding to water main breaks and customer assistance if the property owner cut-off valve does not work or you are unable to locate it. See image:



84

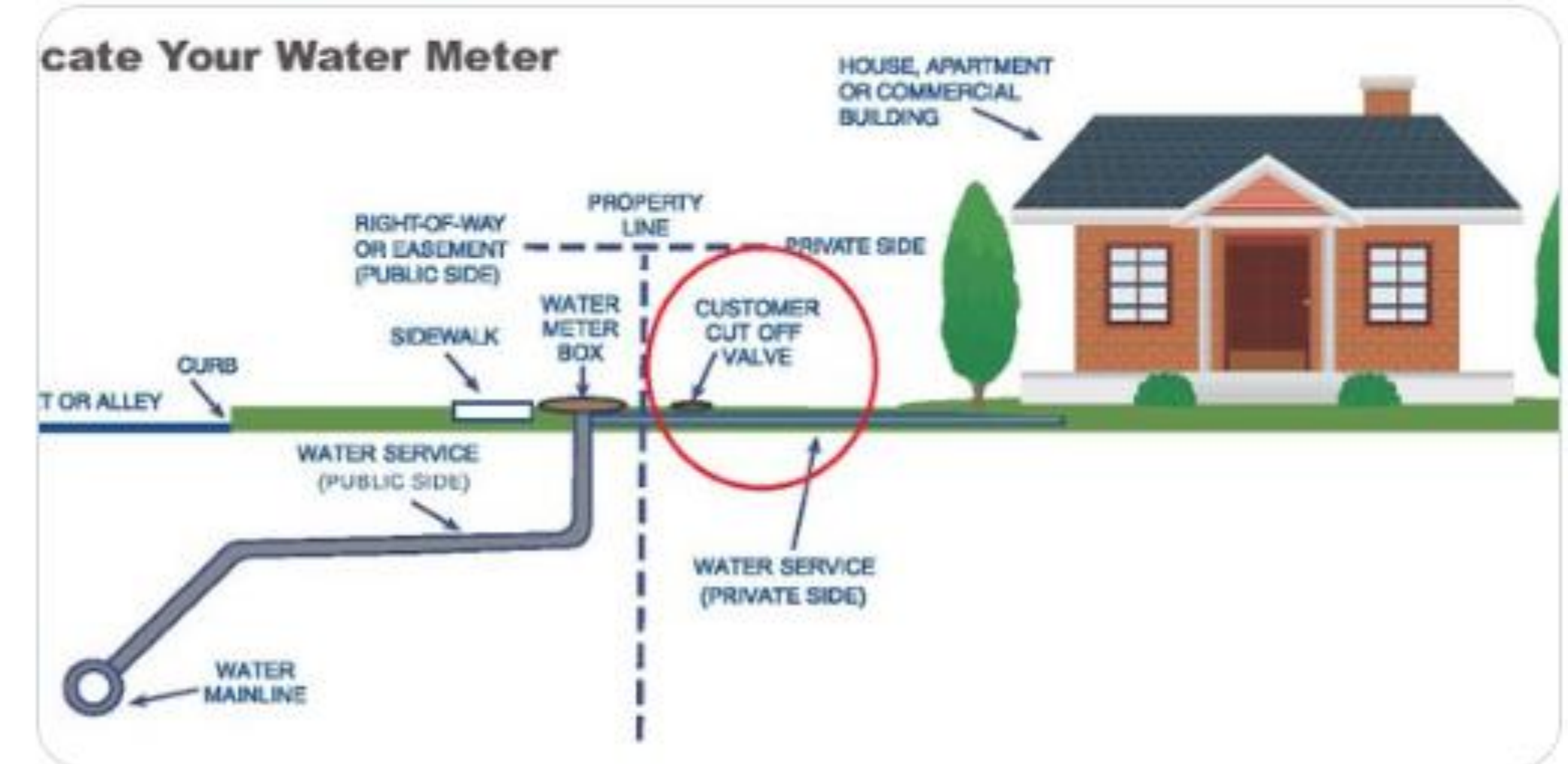
208

262



Austin Water @AustinWater · Feb 16, 2021

1. NO hay planes para interrumpir el servicio de agua. 2. Los equipos de despacho de emergencia 512-972-1000 están respondiendo a las interrupciones de la tubería principal de agua y la asistencia al cliente si la válvula de corte del propietario no funciona o usted no puede ubicarla.

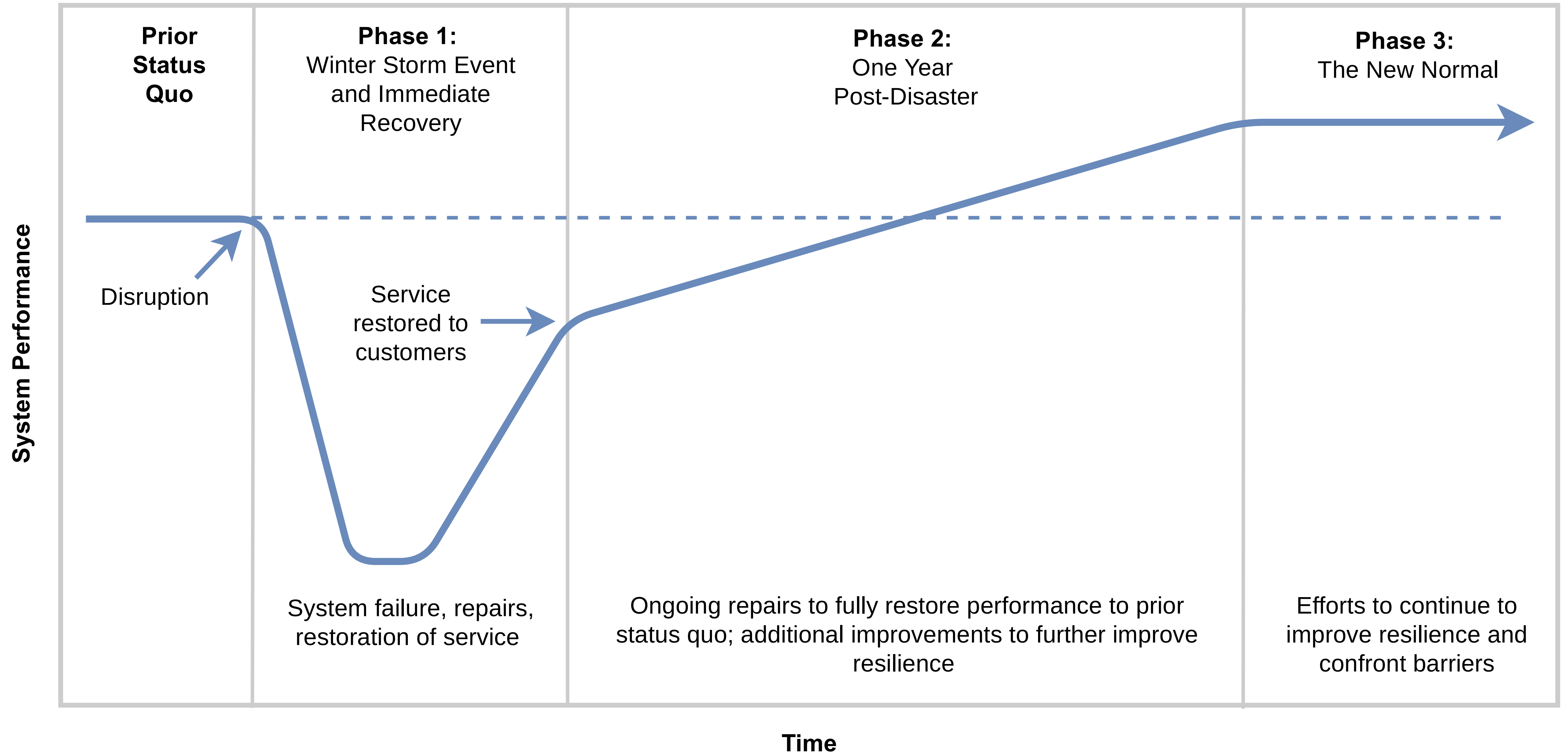


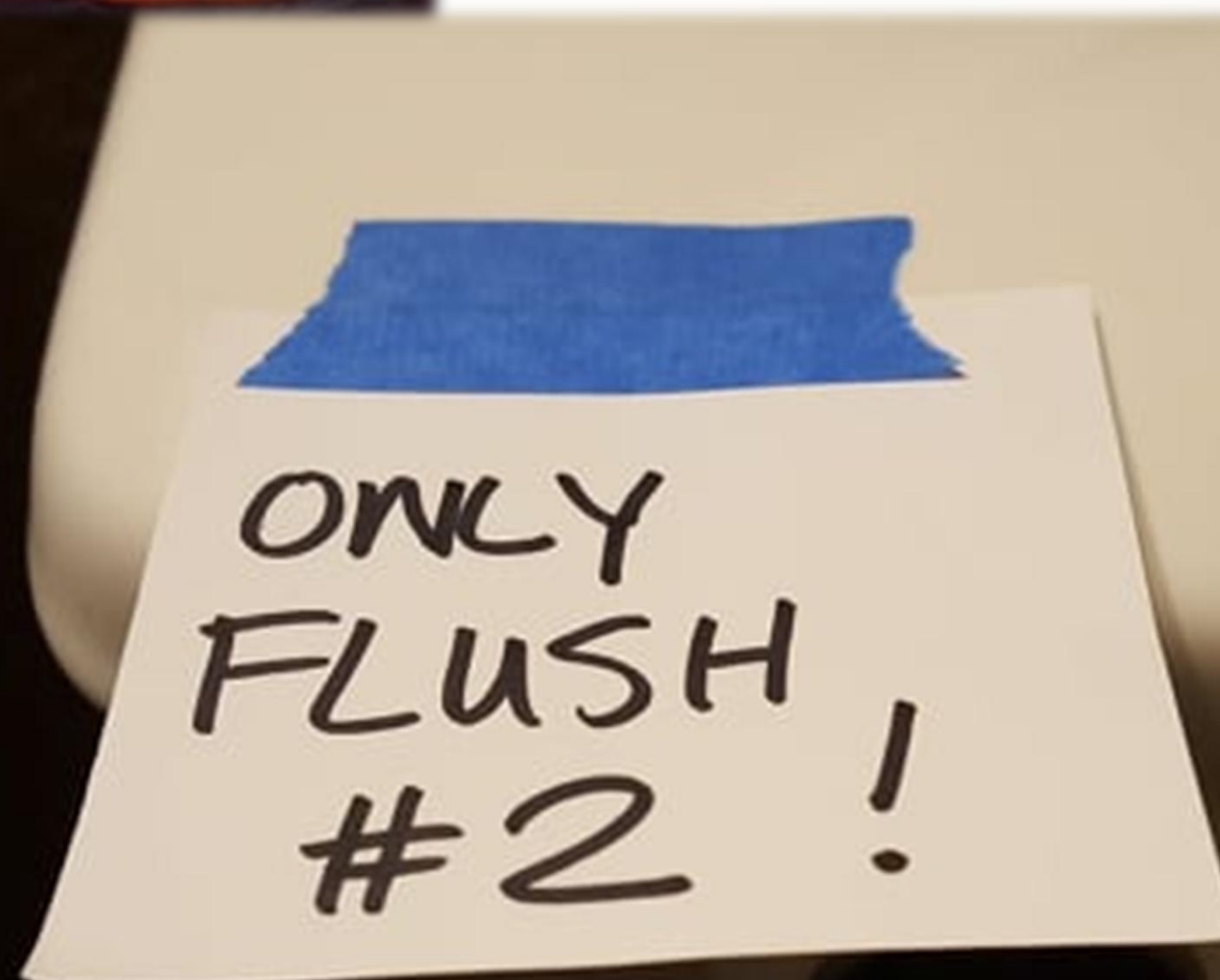
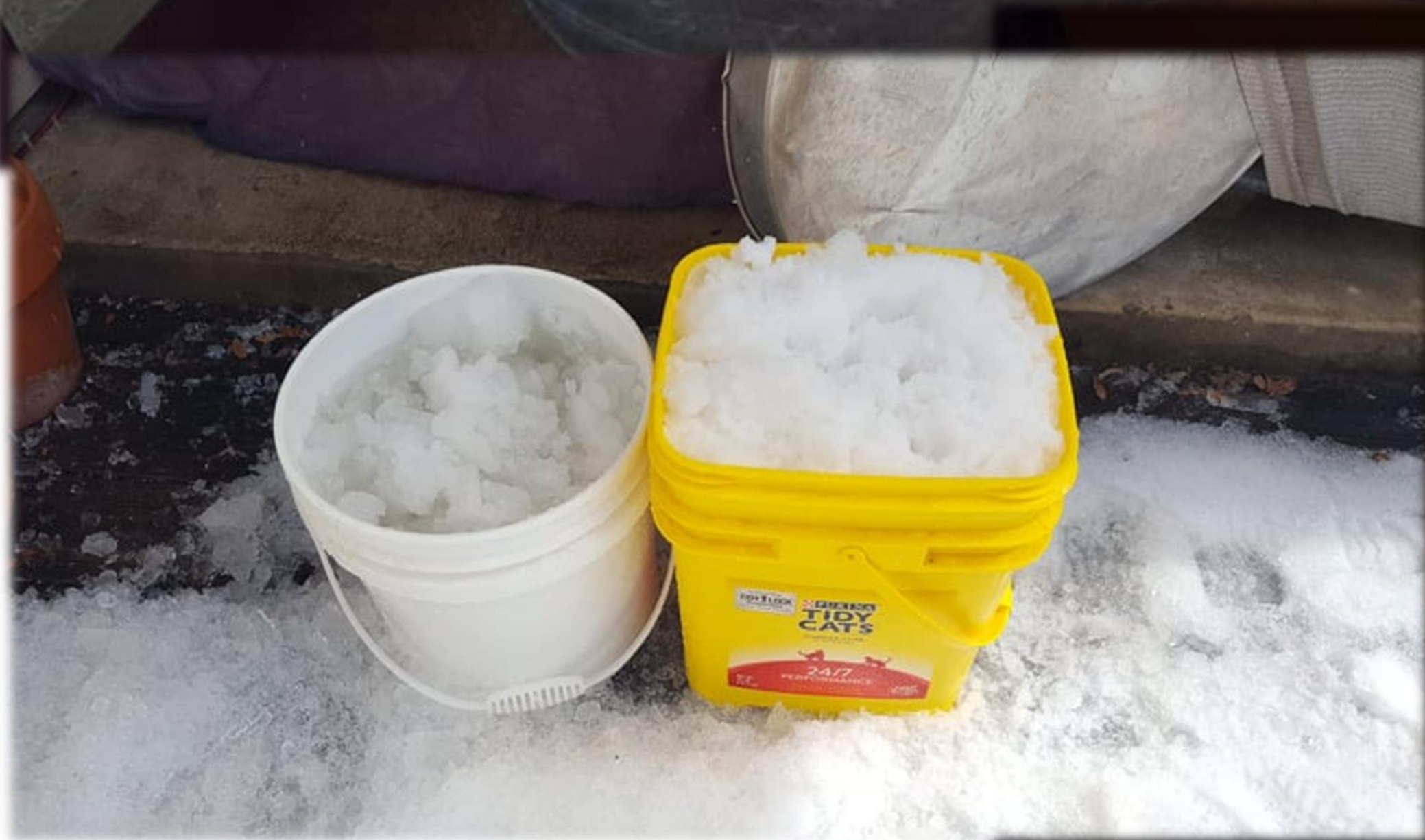
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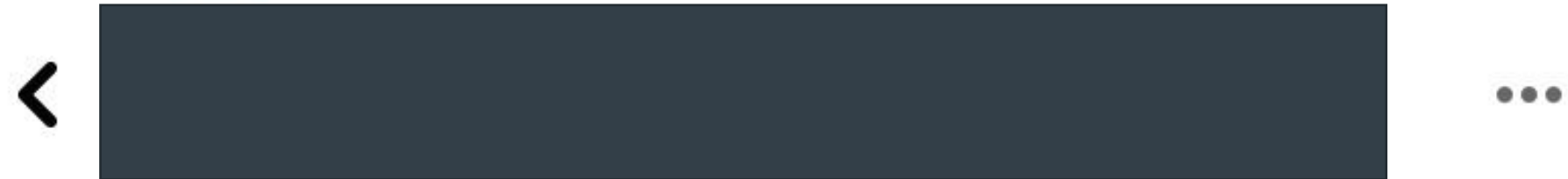




Photos courtesy of Bryna Boehle



Photos courtesy of Lessa Ennis

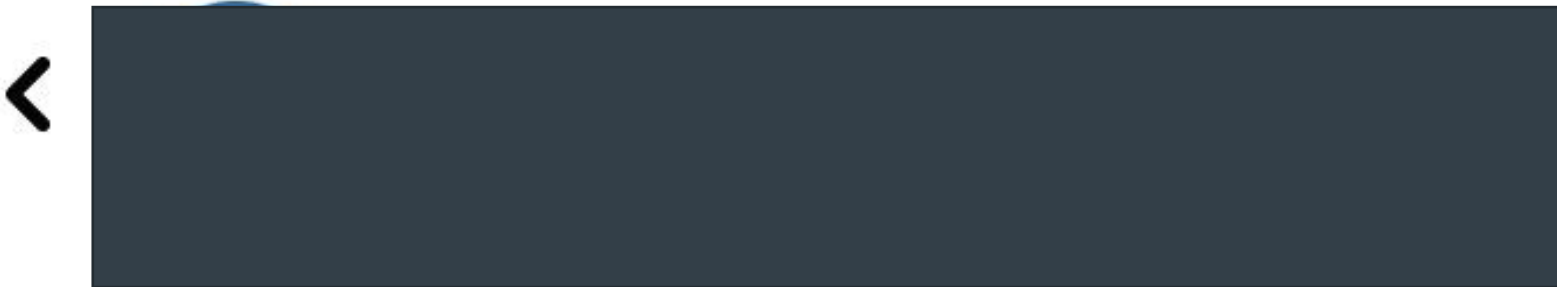


No Water? We need to report it to get prioritized. Please ensure you have submitted a report to Austin Water if you are having issues (no water or low flow) through the following link. Austin Water prioritizes response based upon the number of notices in a given area. Certain areas in SW Austin are not notifying and are lower priority as per report from a friend who talked to Austin Water yesterday. Here's the link to report water outages:

CITYOFAUSTIN.FORMSTACK.COM
Austin Water Issue Report Form - Formstack

Like Comment

11



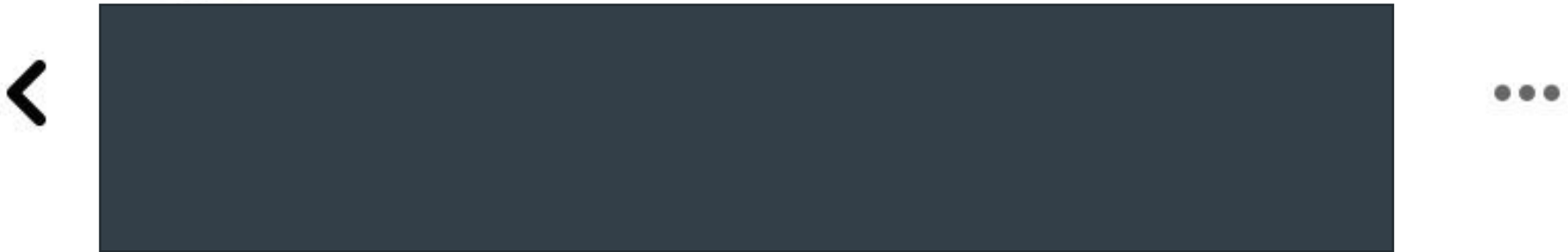
Neighbors, please report your low or loss of water flow to the City. They depend on these reports to establish prioritizing repair service.

CITYOFAUSTIN.FORMSTACK.COM
Austin Water Issue Report Form - Formstack

Like Comment Send

and 35 others

View previous comments...



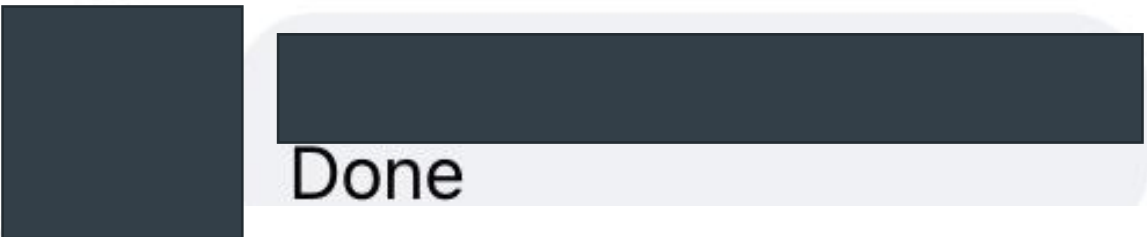
Rumor has it we should report water outages to be considered a priority area- here's the link to report the outage:

CITYOFAUSTIN.FORMSTACK.COM
Austin Water Issue Report Form - Formstack

Like Comment Send

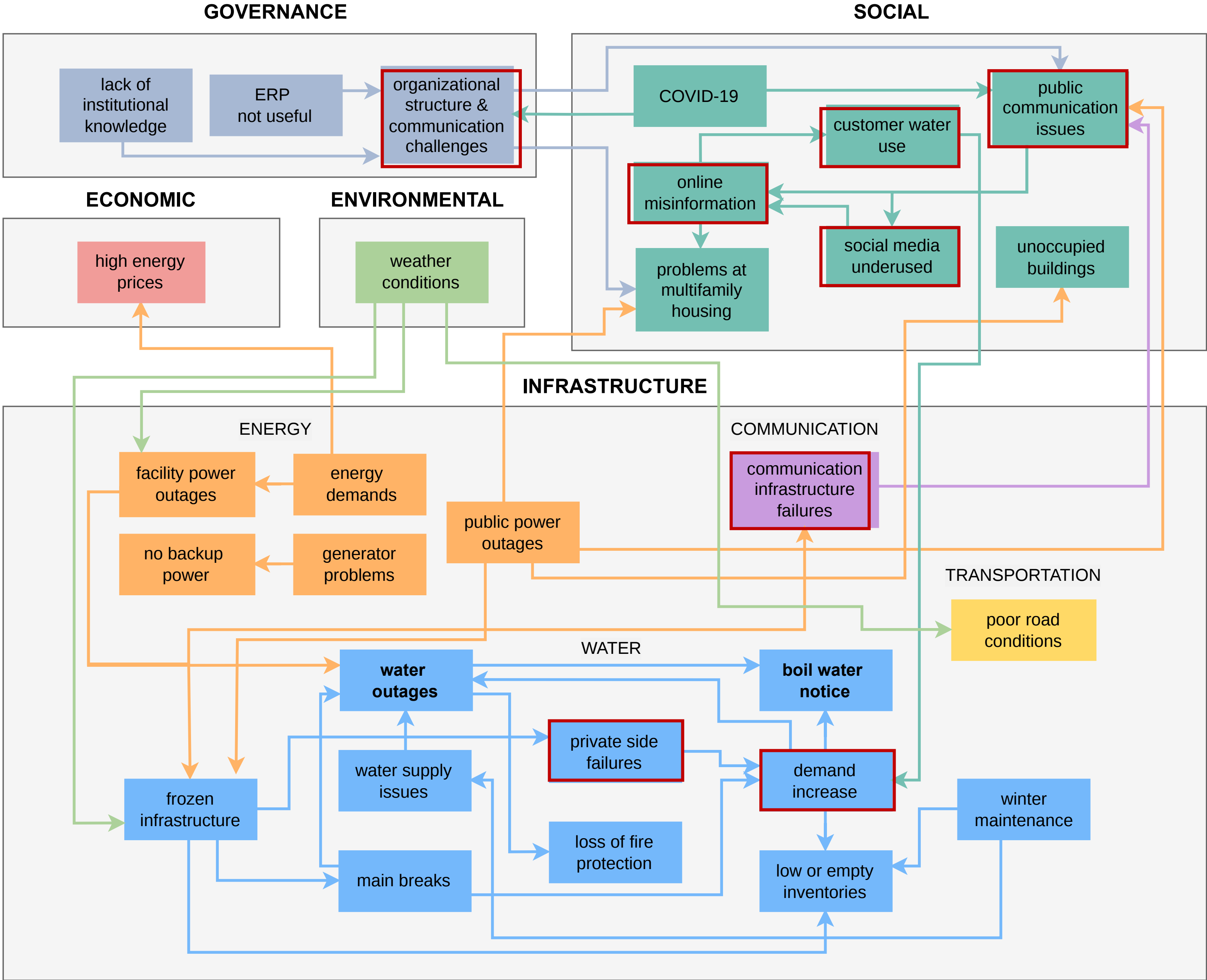
19

View previous comments...



Winter Storm Uri and Immediate Aftermath

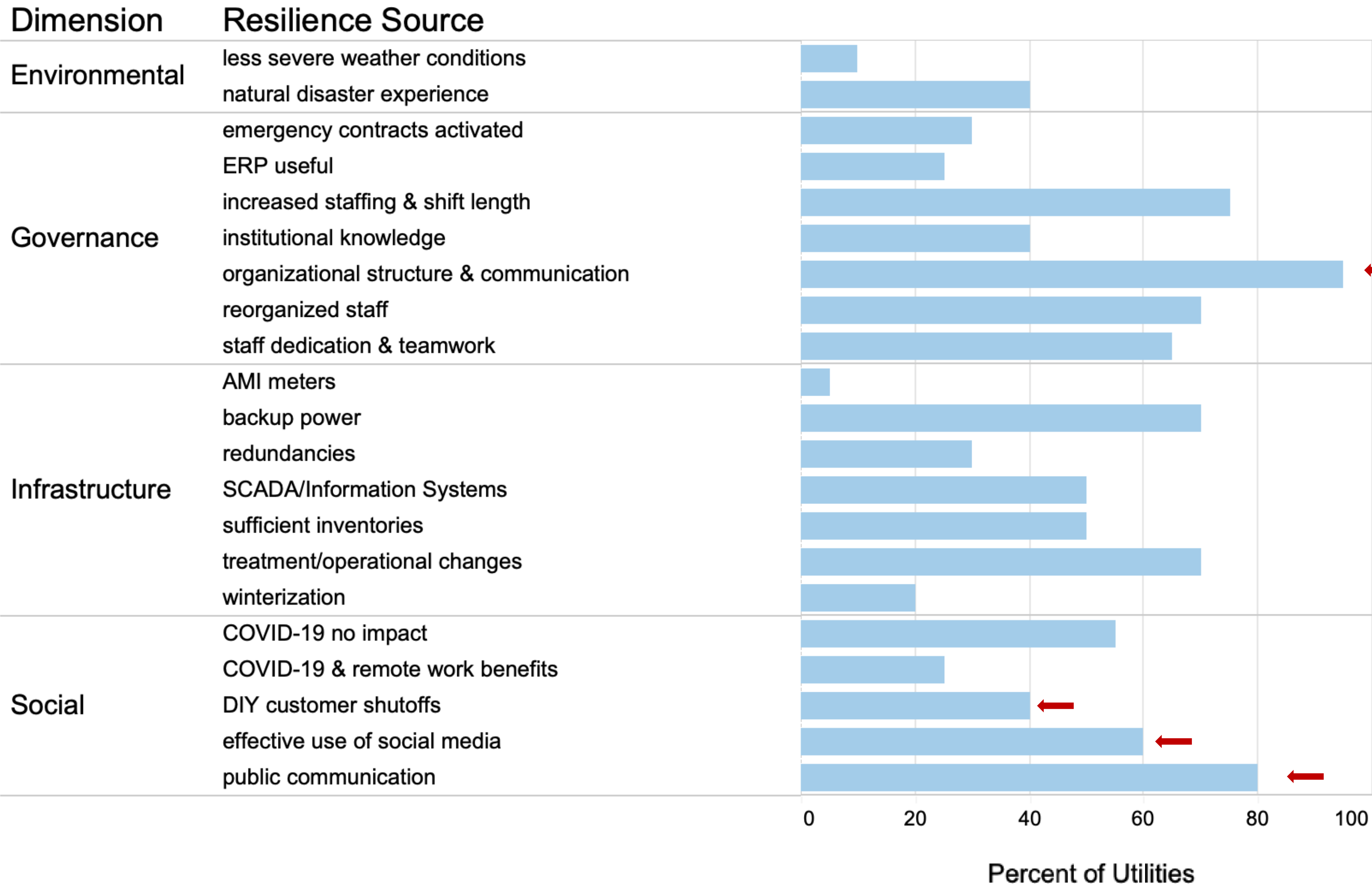
Resilience Gaps



Winter Storm Uri and Immediate Aftermath

Resilience Gaps

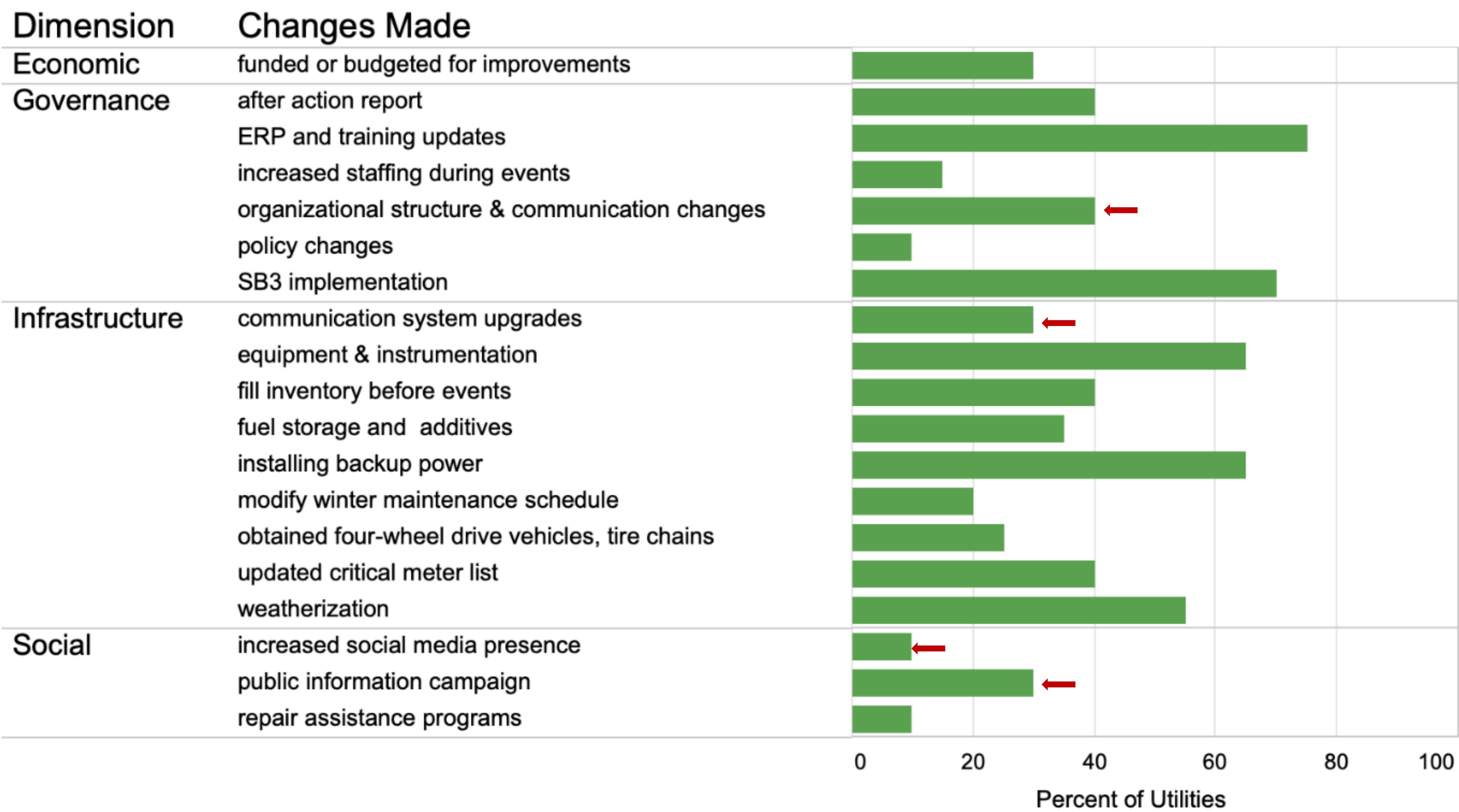
“We’re very much a Facebook town...constant communication on Facebook, that’s how we were disseminating the information.”



One Year Later

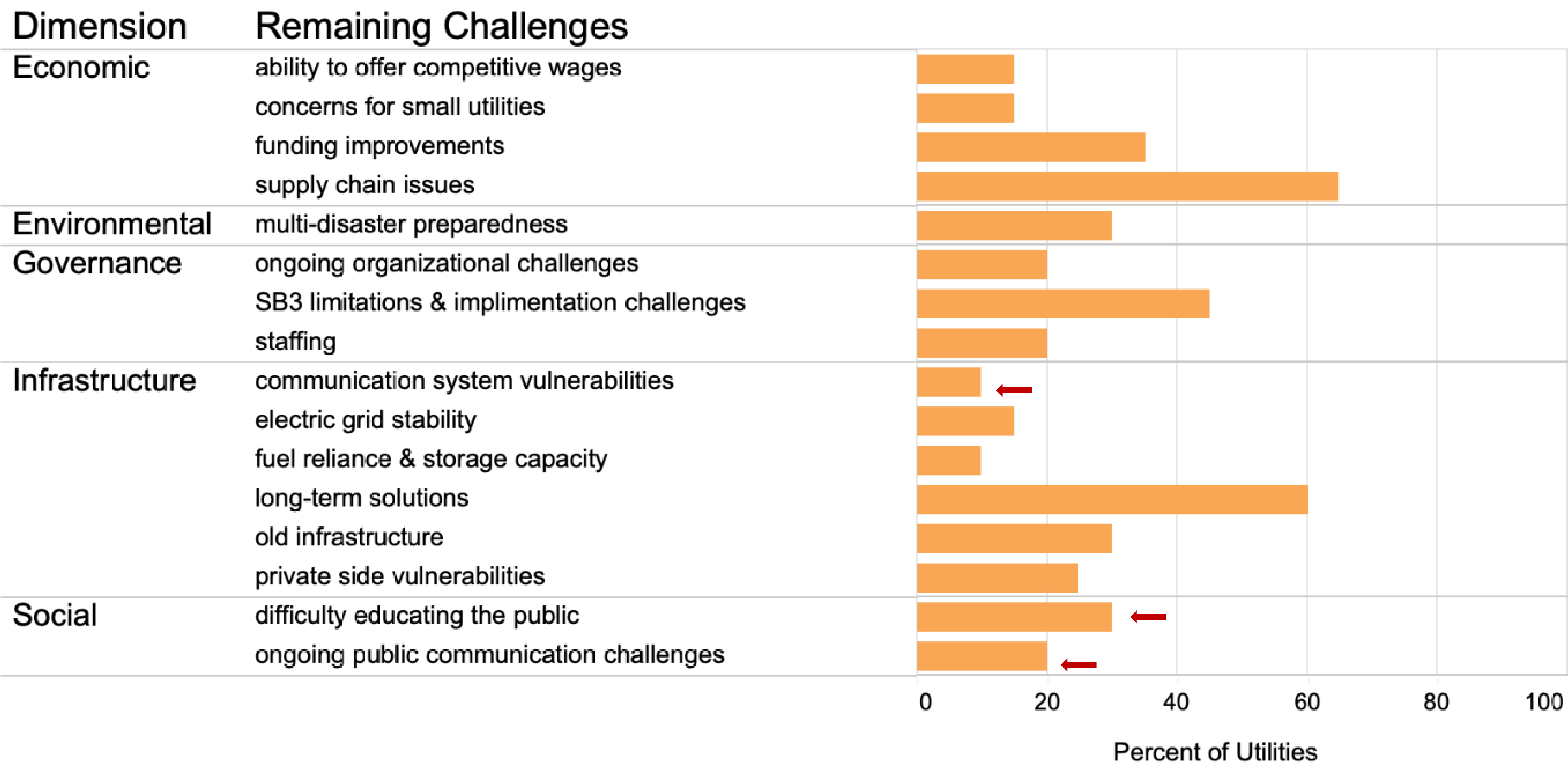
Tiedmann et al. 2023

“Have we updated [our ERPs]? Most definitely, we have now updated them to be thoughtful and cognizant of weather events.”

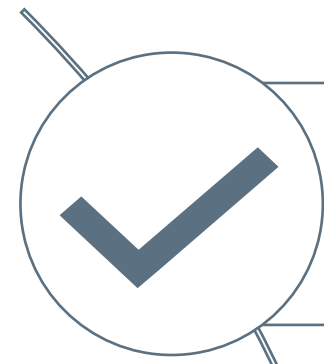


“The New Normal”

Tiedmann et al. 2023



Key Takeaways



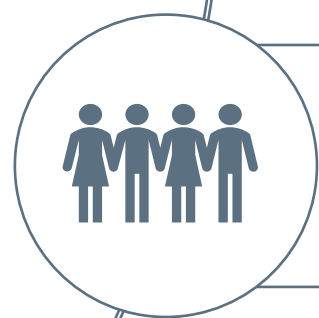
Improvements made in infrastructure and governance dimensions



Challenges remain surrounding long-term infrastructure improvements



Funding and governance support for necessary improvements lacking



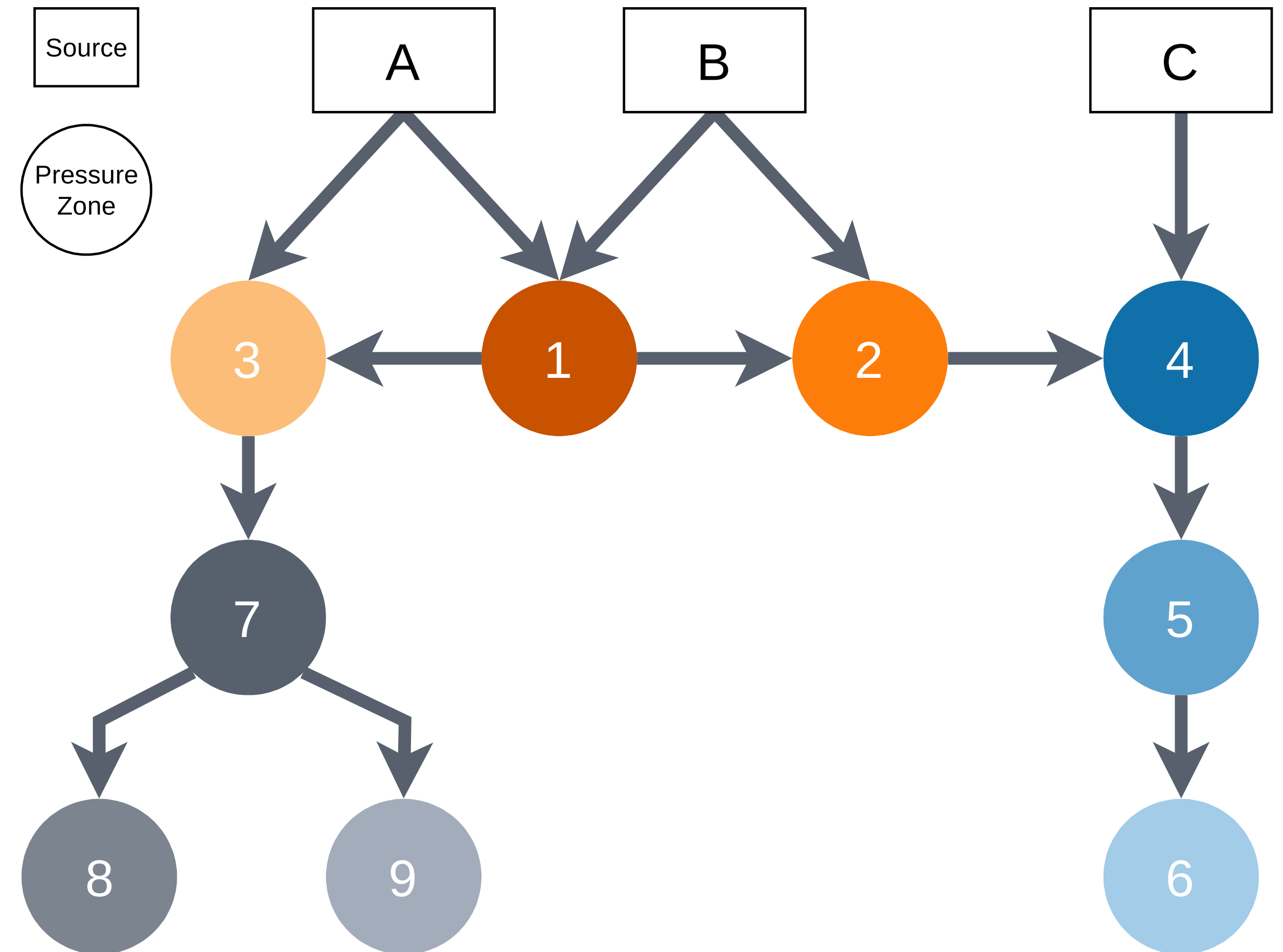
Improving public communication is critical to building resilience in the social dimension



Recommendations offered for policymakers and utility managers

Study Area

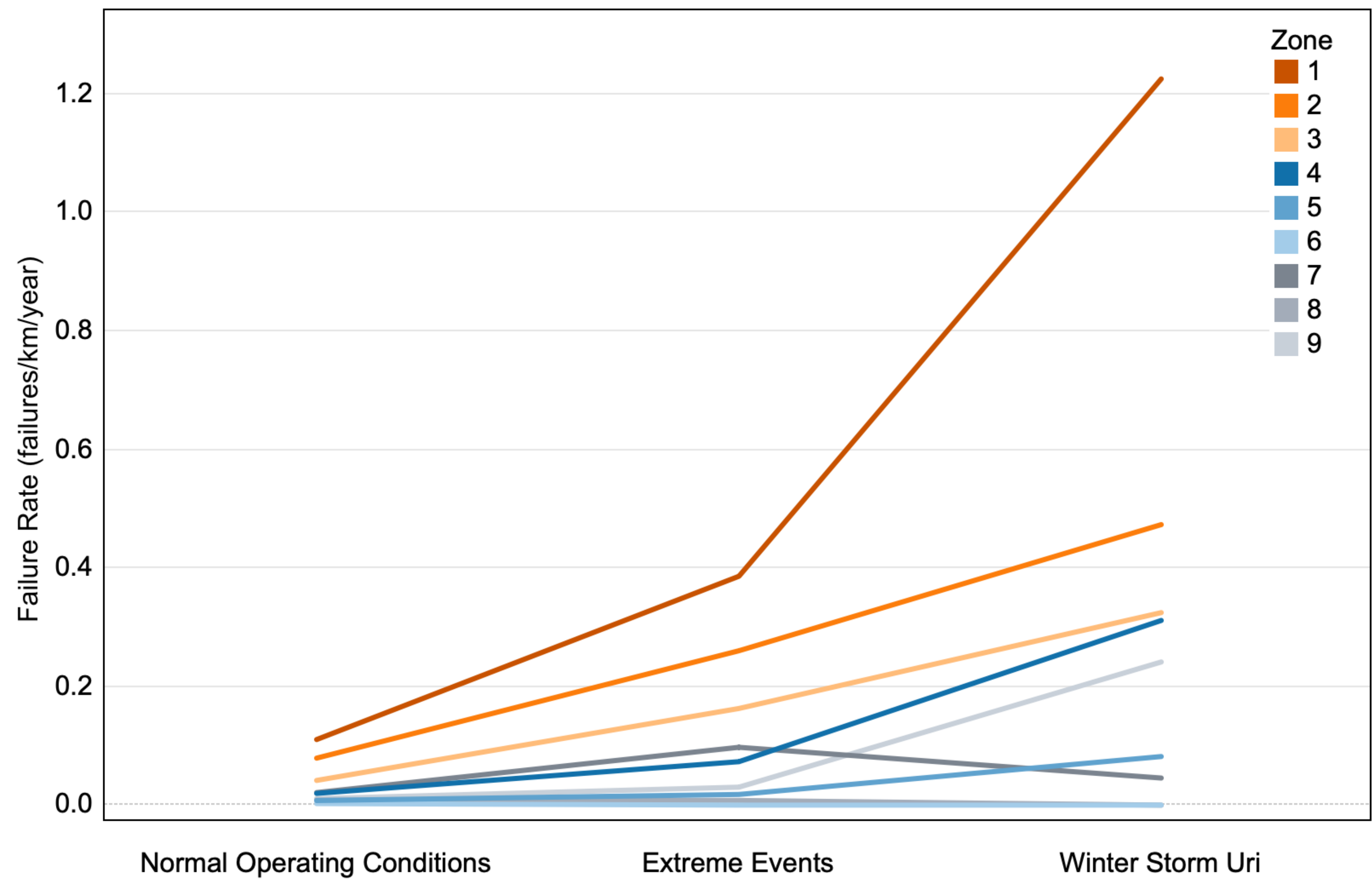
- 9 pressure zones
- 3 water sources (treatment plants)



Failure Rates

$$\text{failure rate} = \frac{\# \text{ of failures}}{\text{total length of pipe}}$$

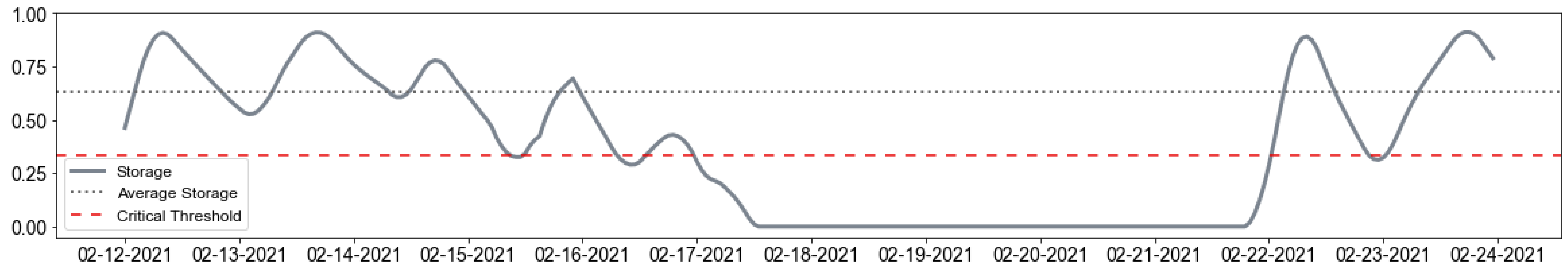
$$= \text{failures/km/year per zone}$$



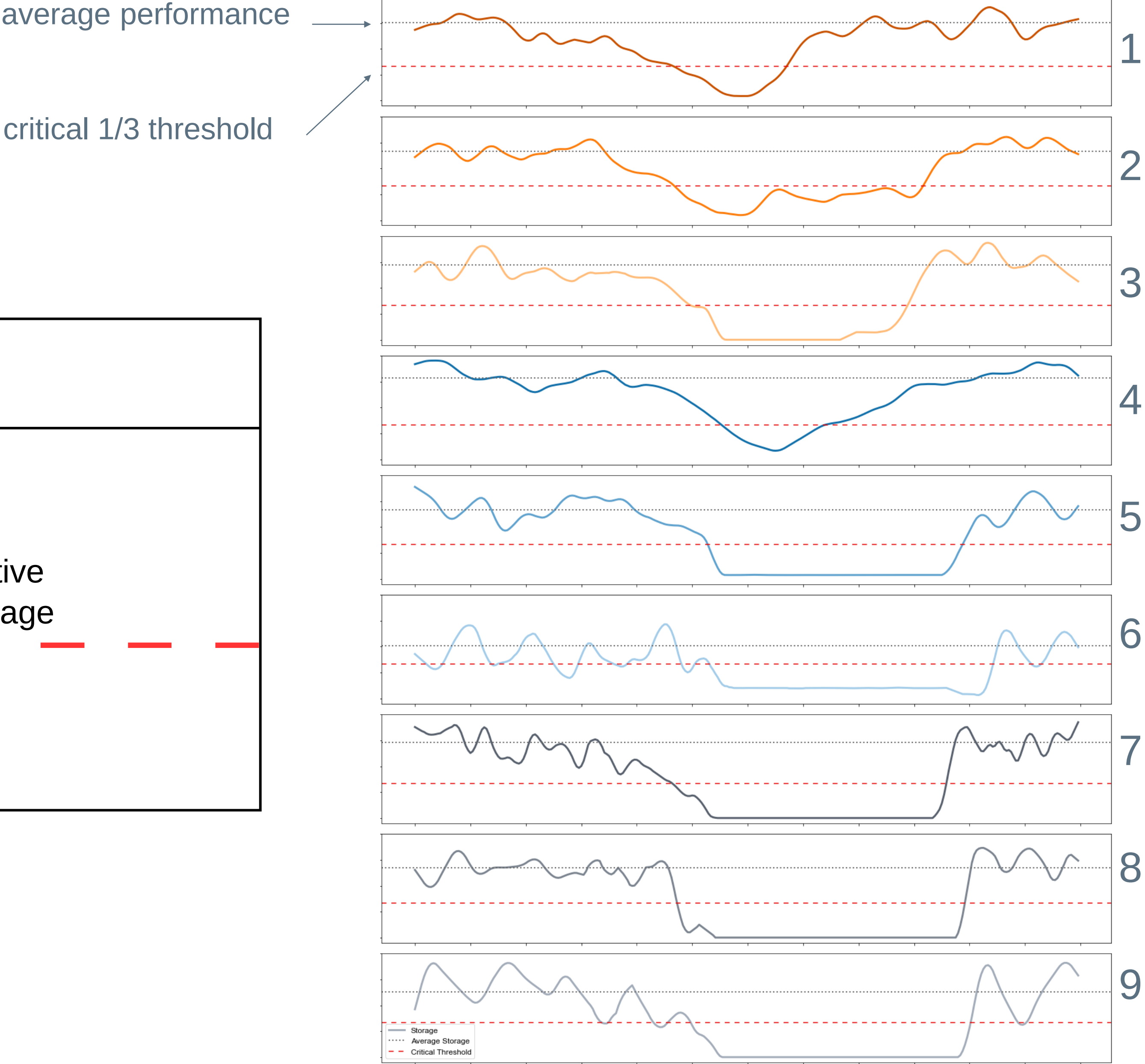
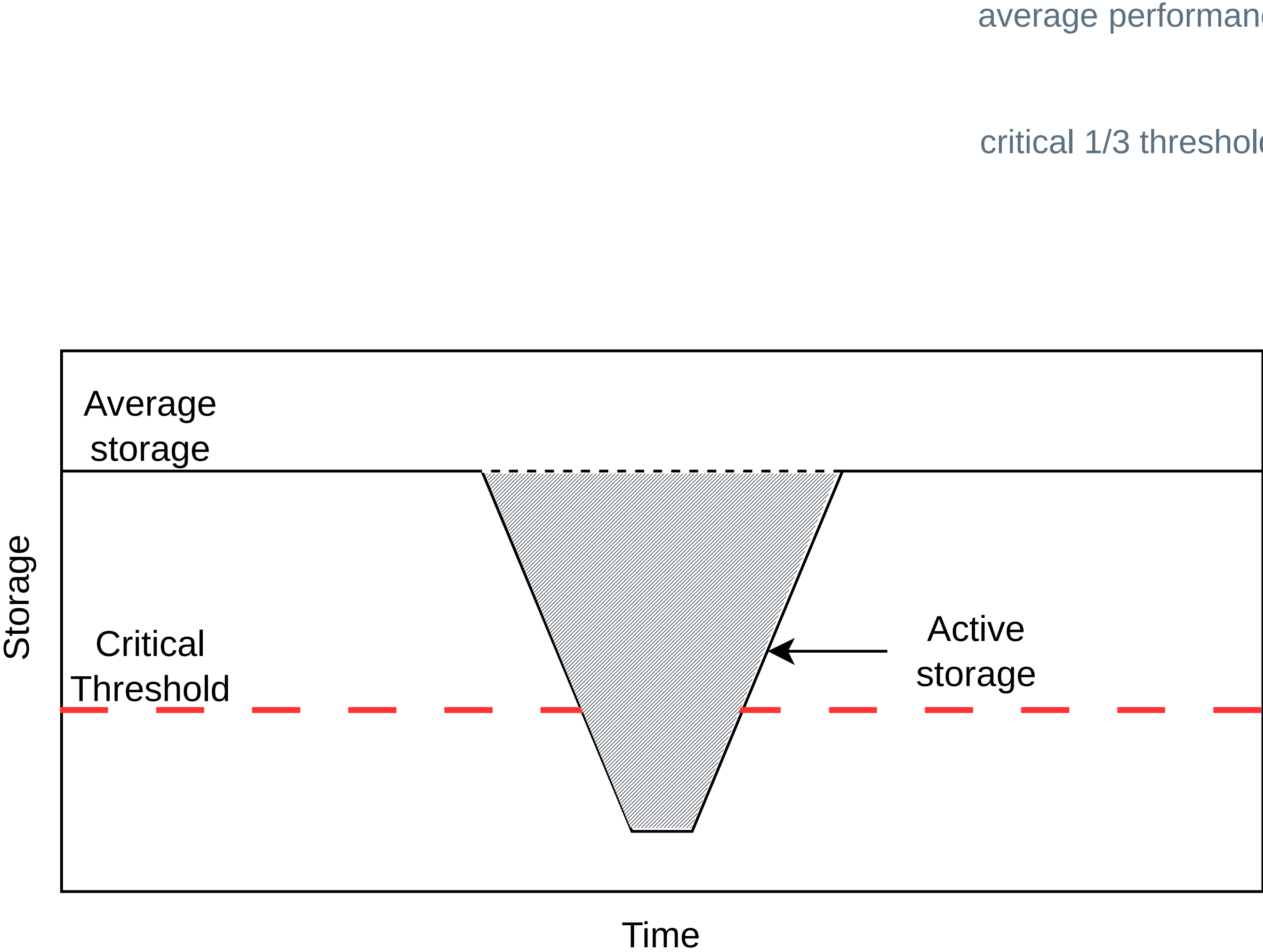
Why does this all matter for communication?

Reservoir storage by zone:

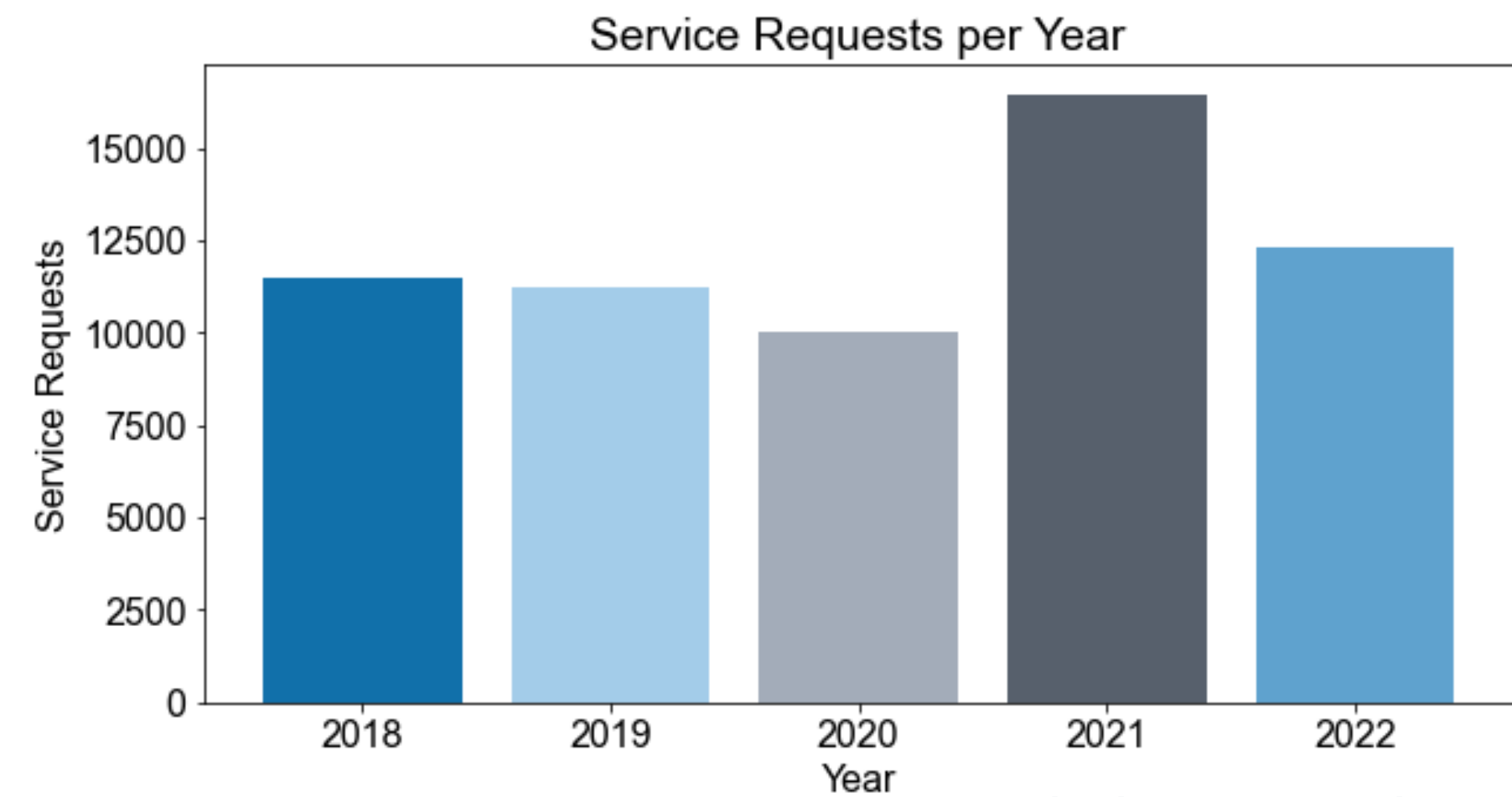
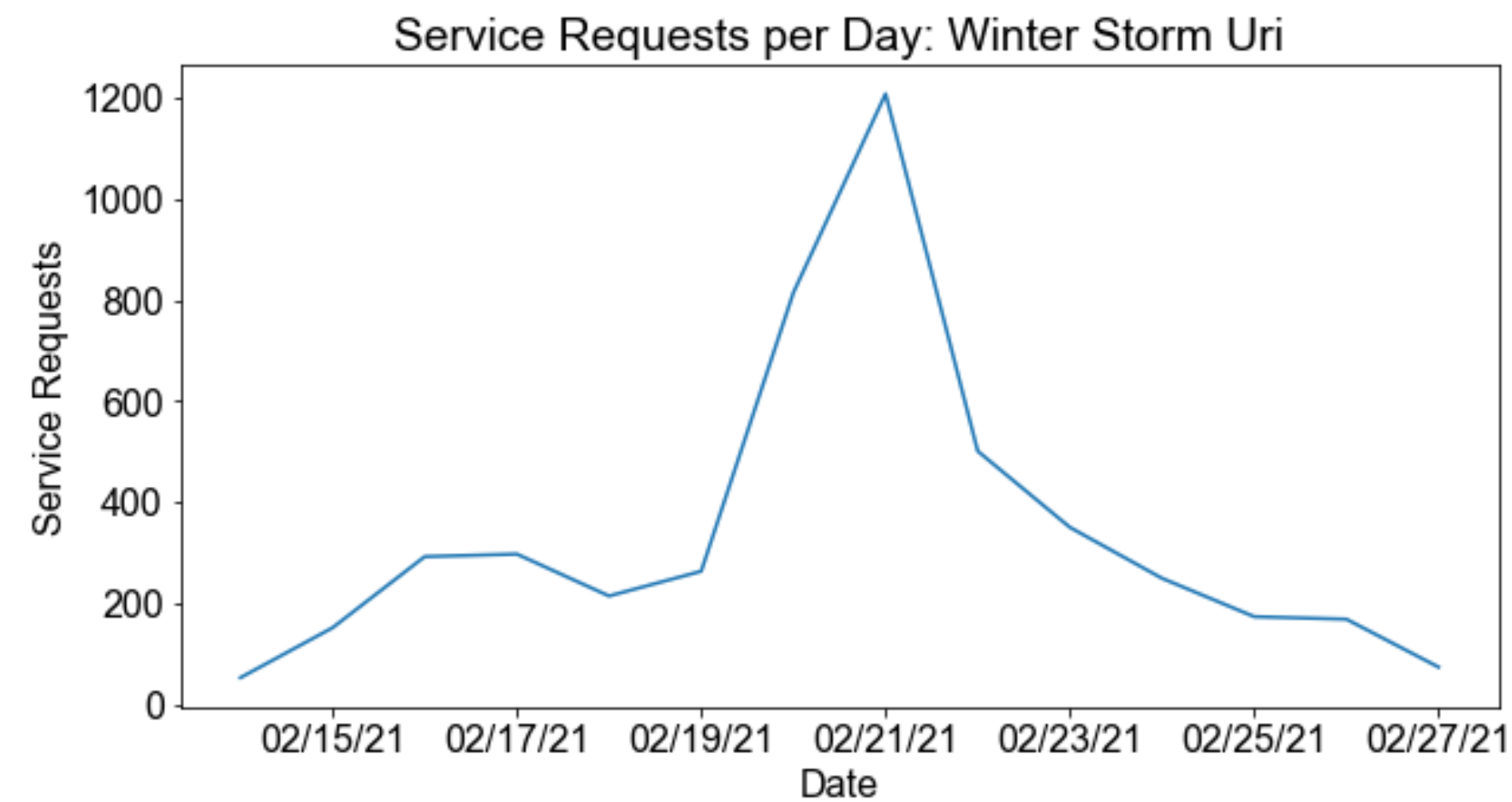
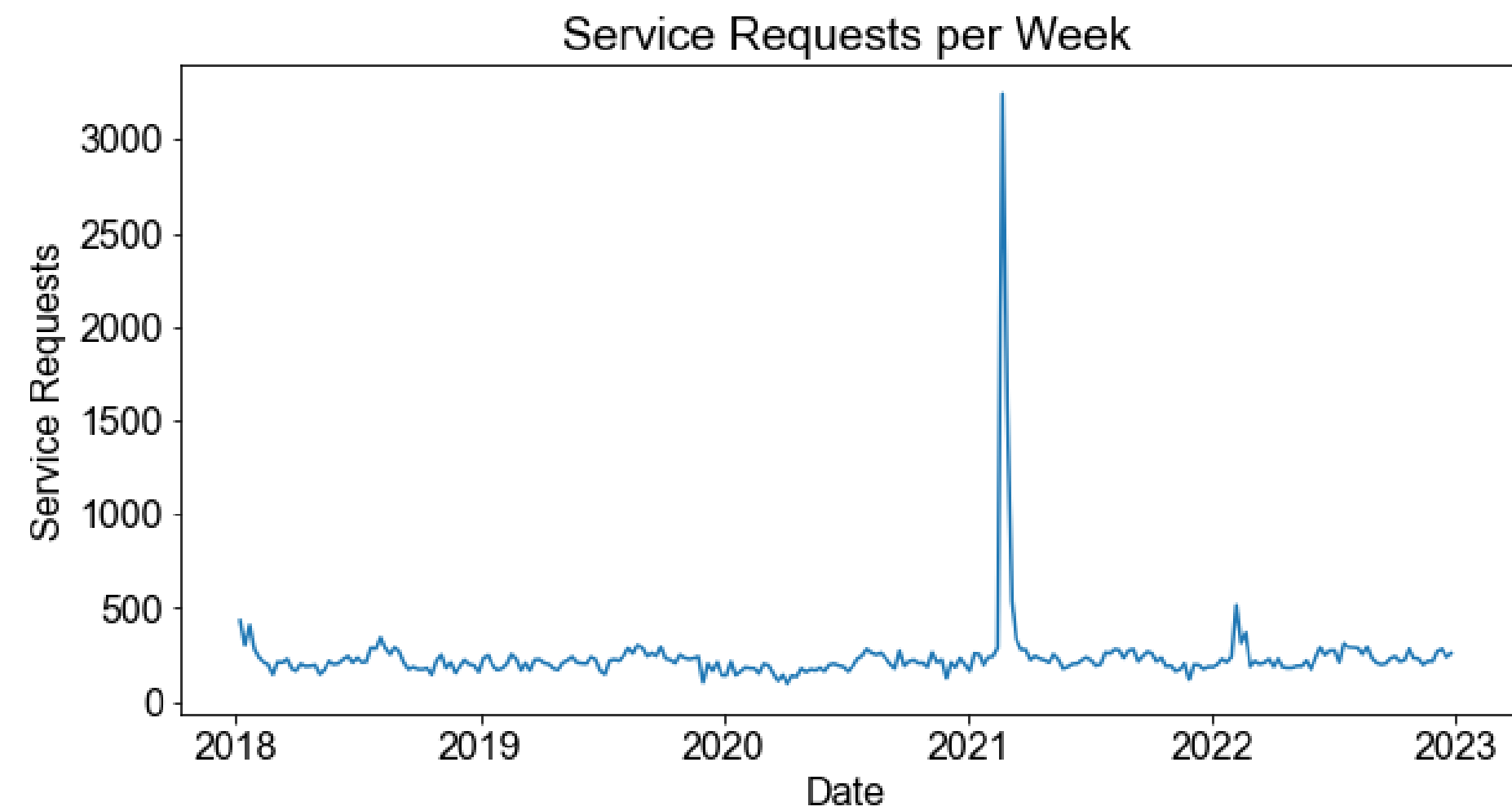
Measure of available water for customers and ability of system to absorb shocks or disruptions



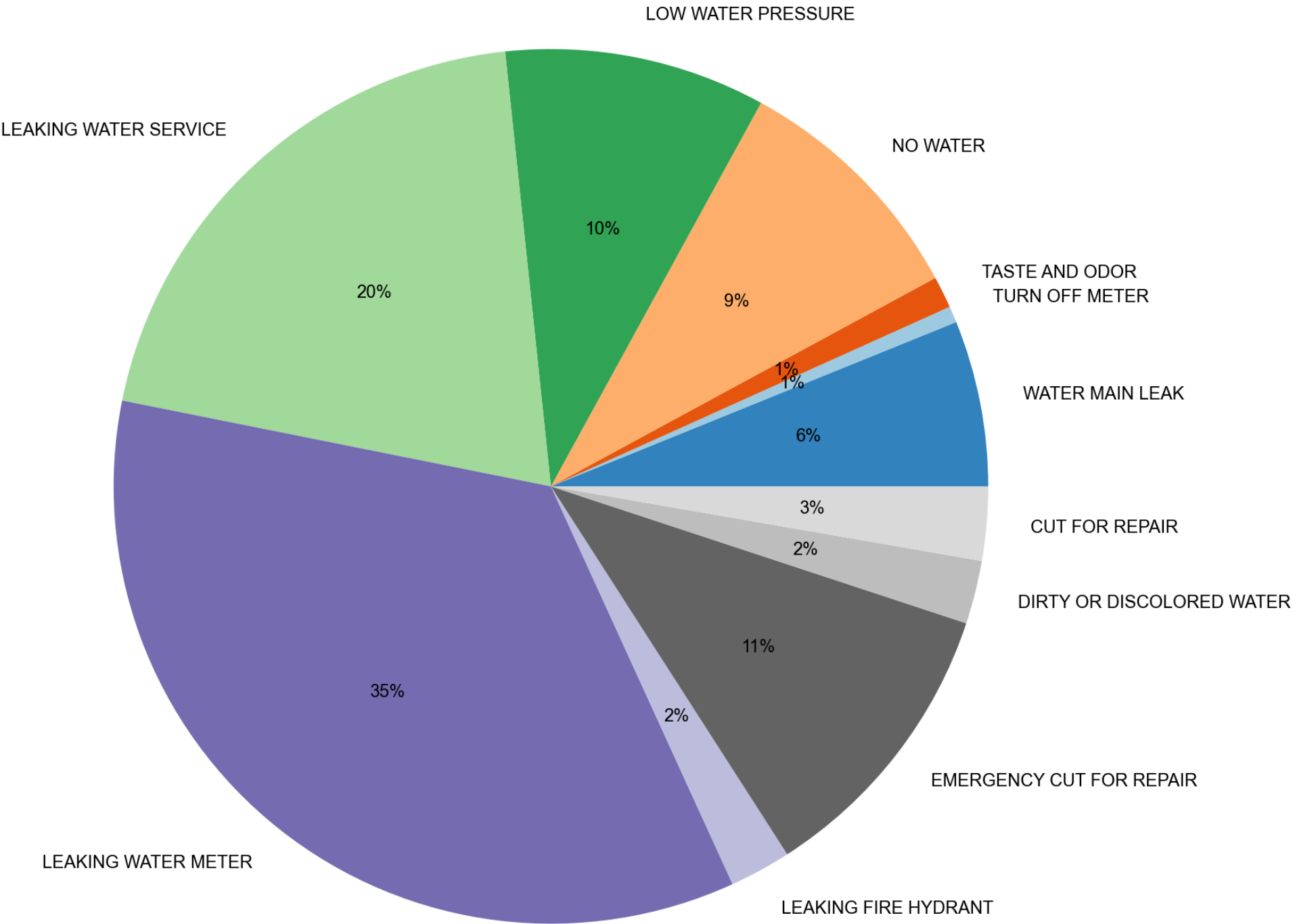
Resilience Curves



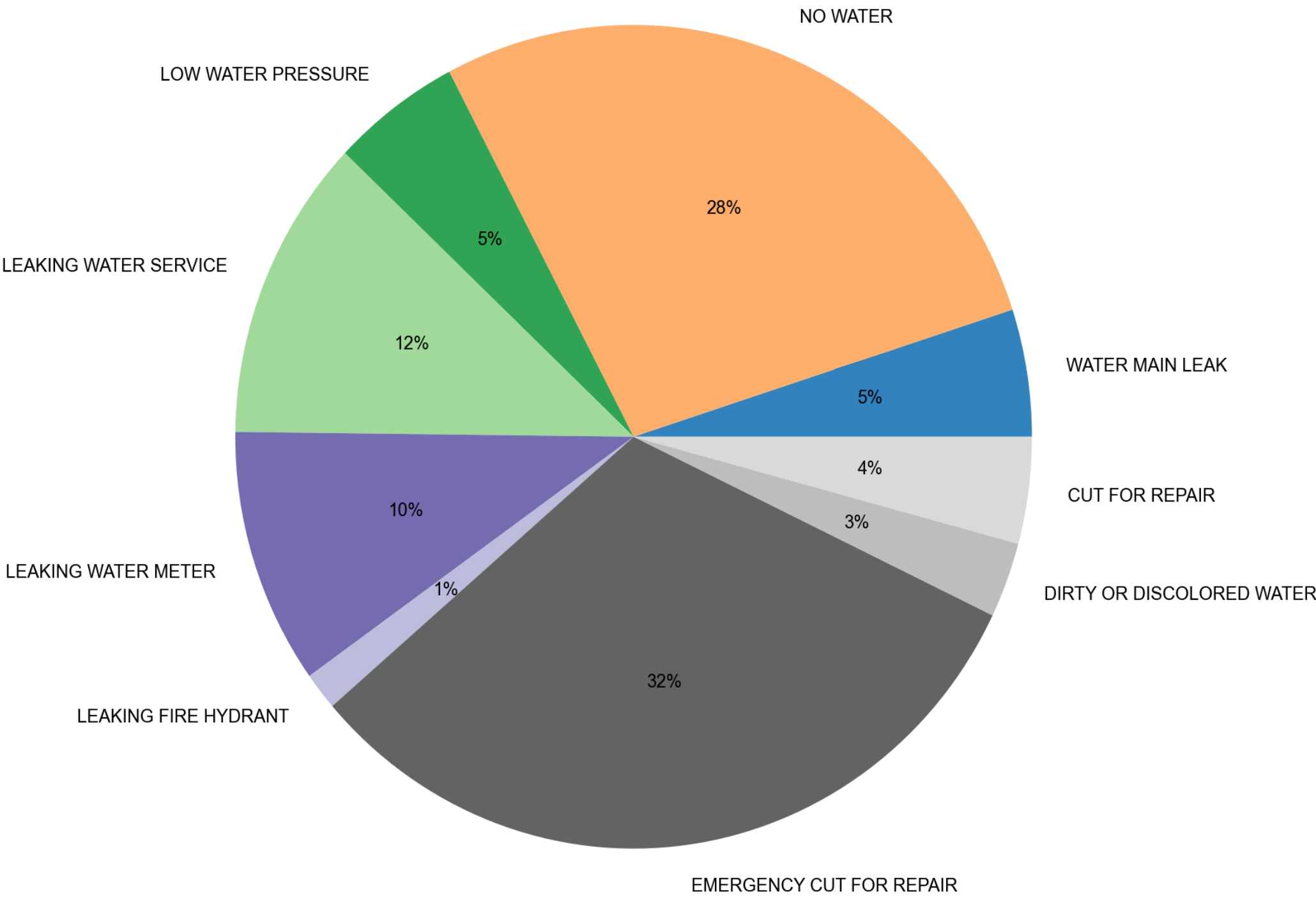
Are customers reliable sensors?



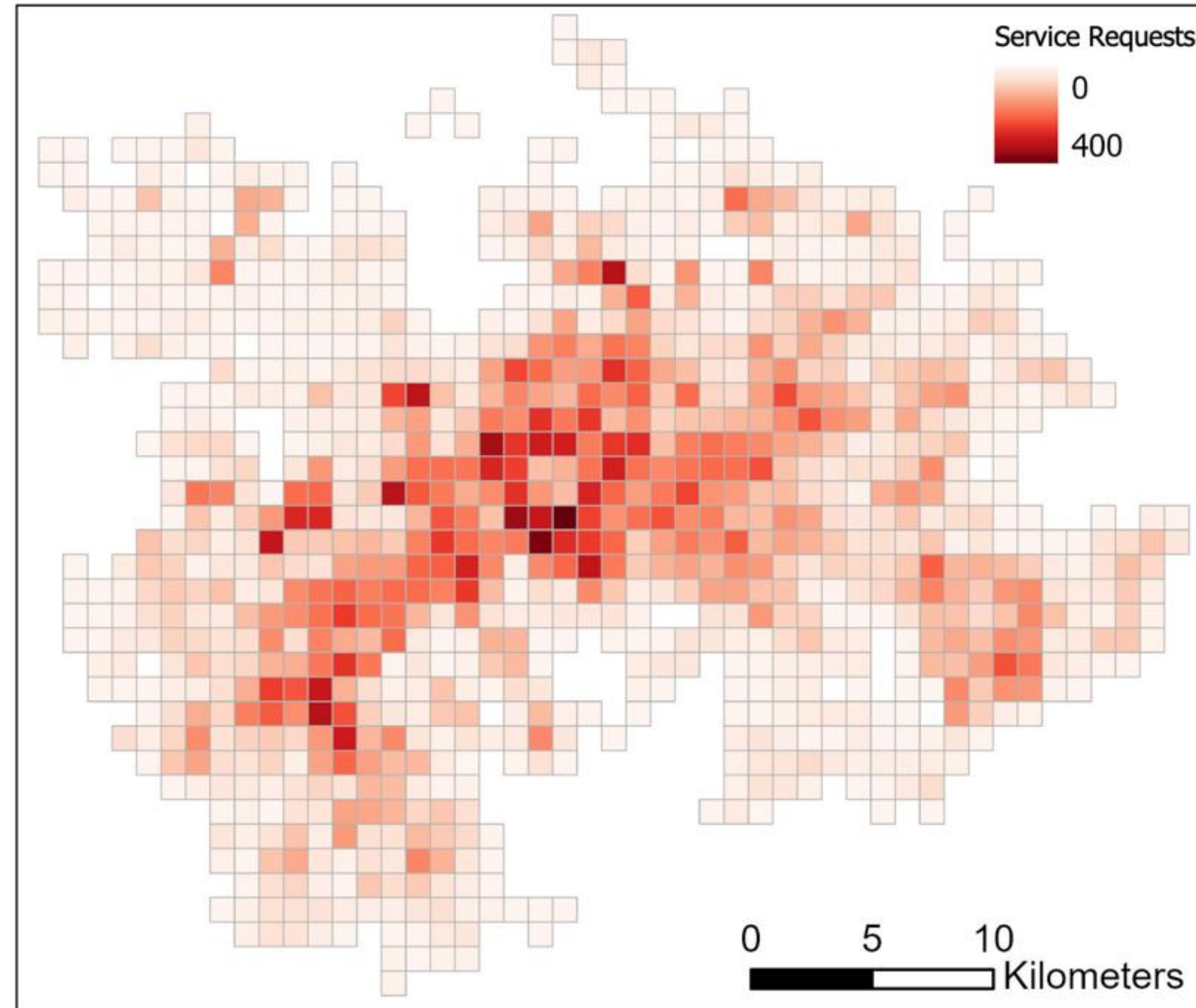
Service Requests by Problem Type: Non-Winter Storm Uri



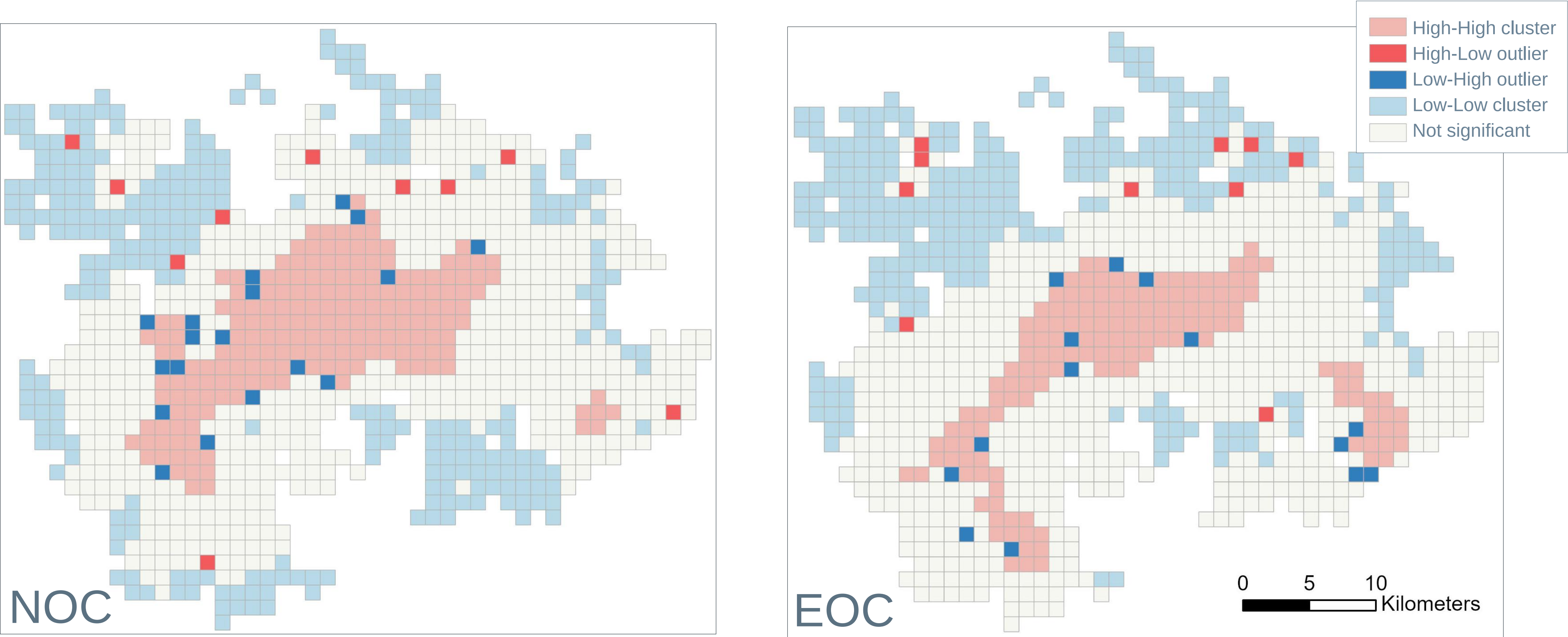
Service Requests by Problem Type during Winter Storm Uri



Do spatial patterns exist in customer reporting?



Clusters exist on local scale in NOC and EOC

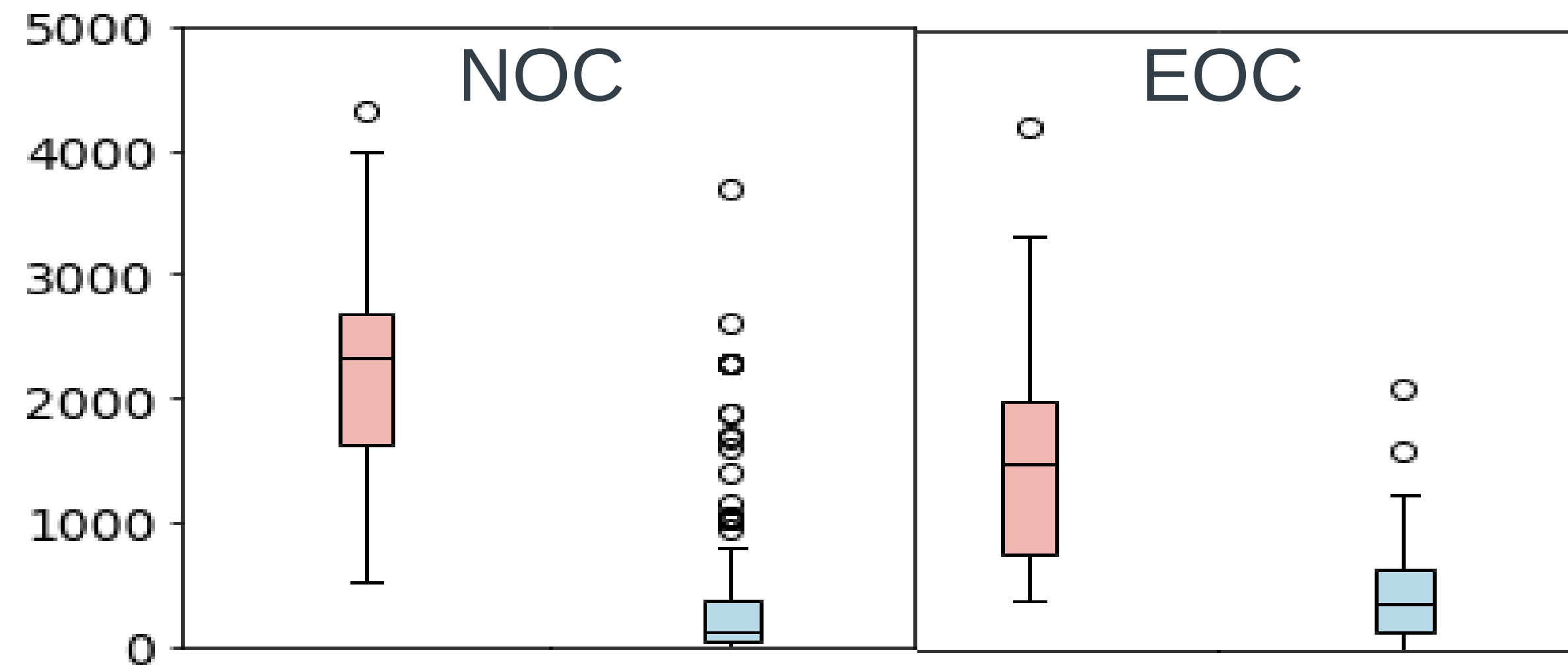


NOC = Normal Operating Conditions
EOC = Emergency Operating Conditions

high and low levels of customer reporting—i.e., hotspots and coldspots

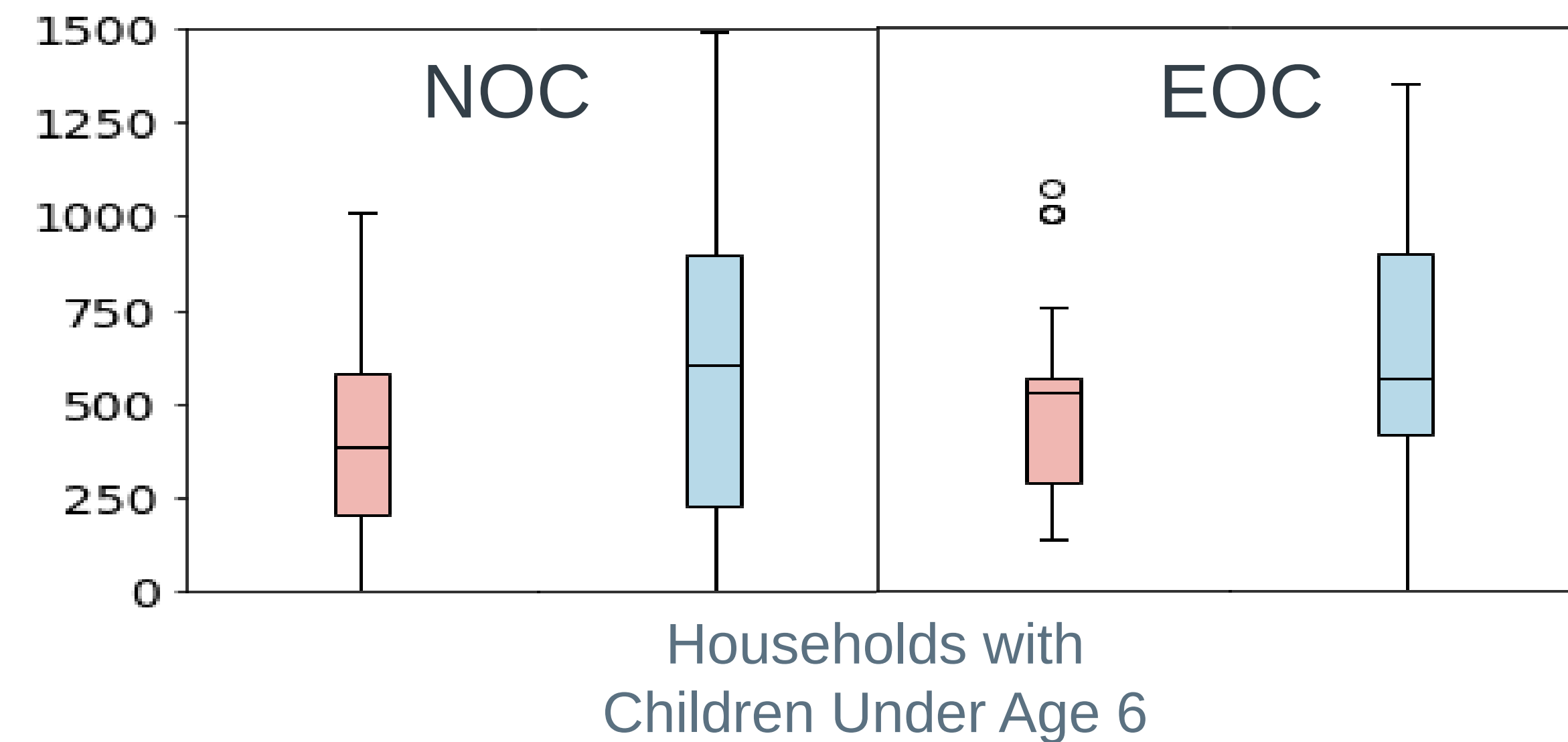
Population density: statistically significant in NOC and EOC

- Hotspots were **denser** than coldspots
- More people = more reporting
- Difference **decreased slightly** between new EOC clusters



Age variables: differences less significant during EOC

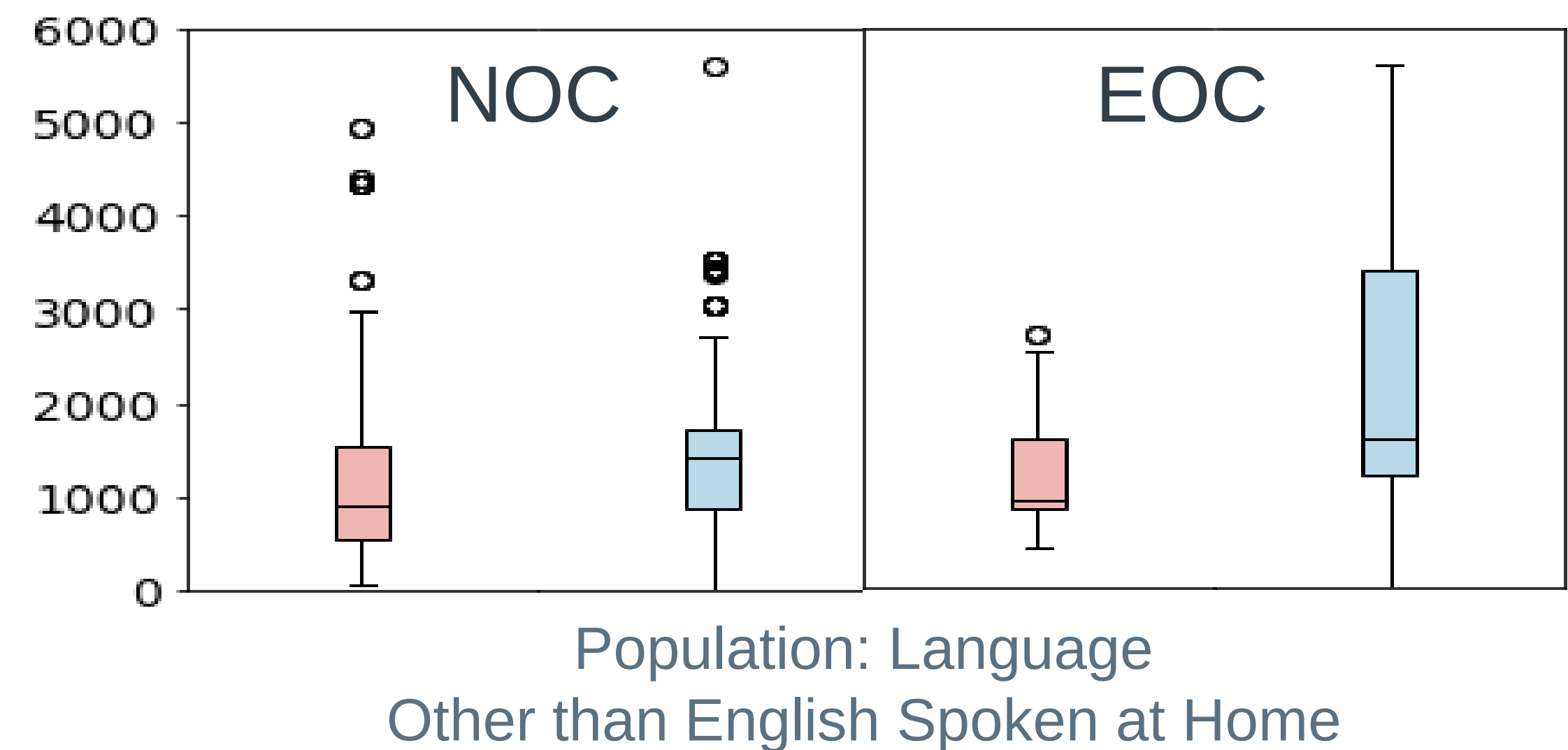
- Differences **highly statistically significant** during NOC
- Coldspots had **larger populations** of both groups during NOC
- Differences became **less statistically significant** or **disappeared** during EOC



➤ Vulnerable populations need emergency resources

Language & ethnicity variables: differences more significant during EOC

- Differences statistically significant during NOC
- Coldspots had larger populations of both groups
- Differences increased and became *highly* statistically significant during EOC



➤ Gaps widening during emergency

Key Takeaways



Spatial patterns in customer reporting exist at a global and local scale



Sociotechnical drivers of customer reporting were different in NOC vs EOC



Customers report public side issues more thoroughly during EOC



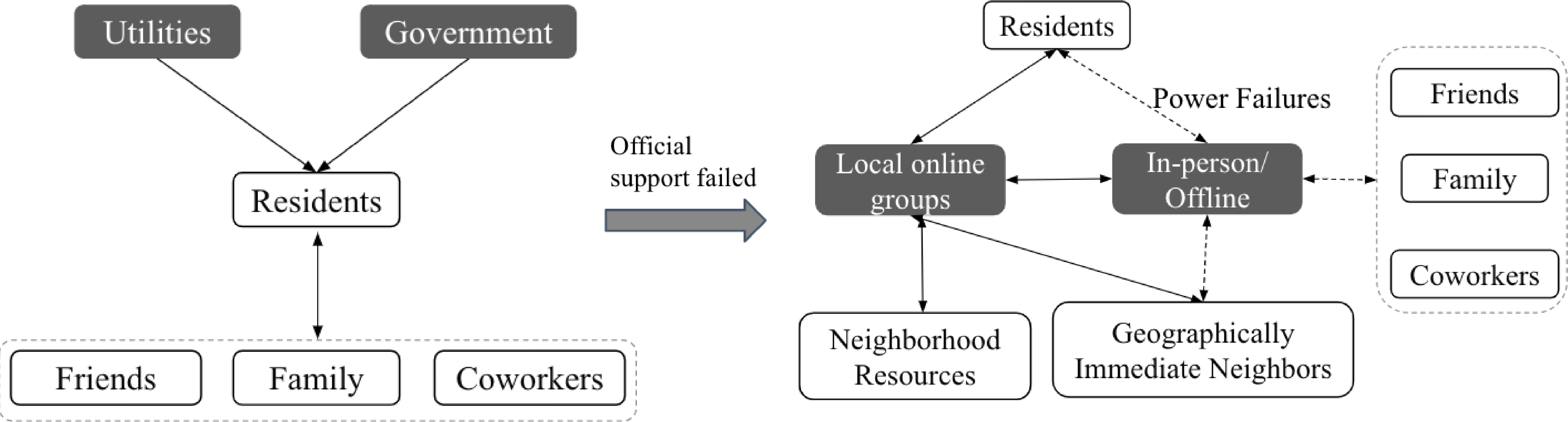
Different groups may need specialized outreach approaches for communication during NOC and EOC



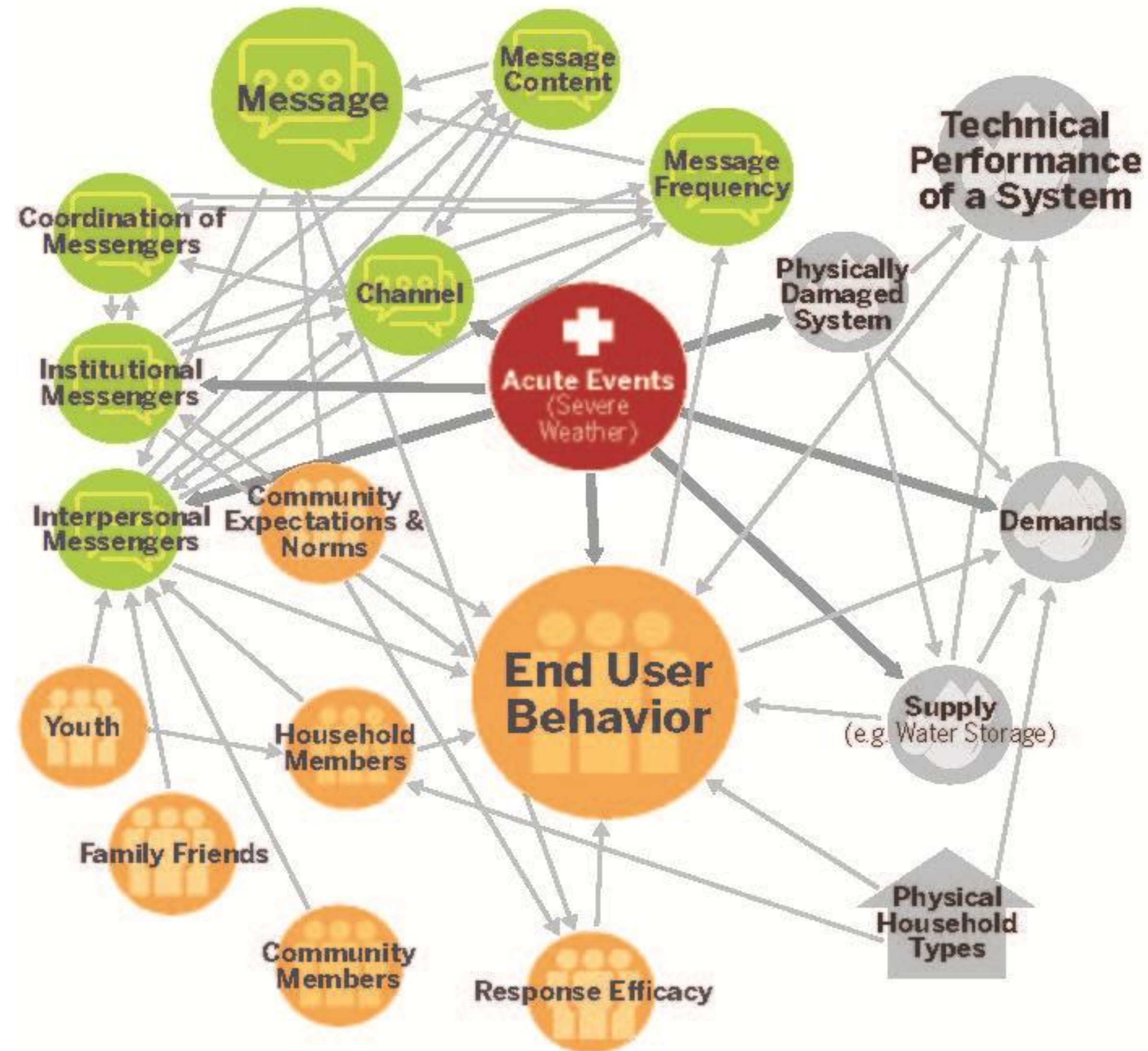
Highlights the importance of managing and utilizing customer reporting data

Resiliency Strategy: Adapting communication

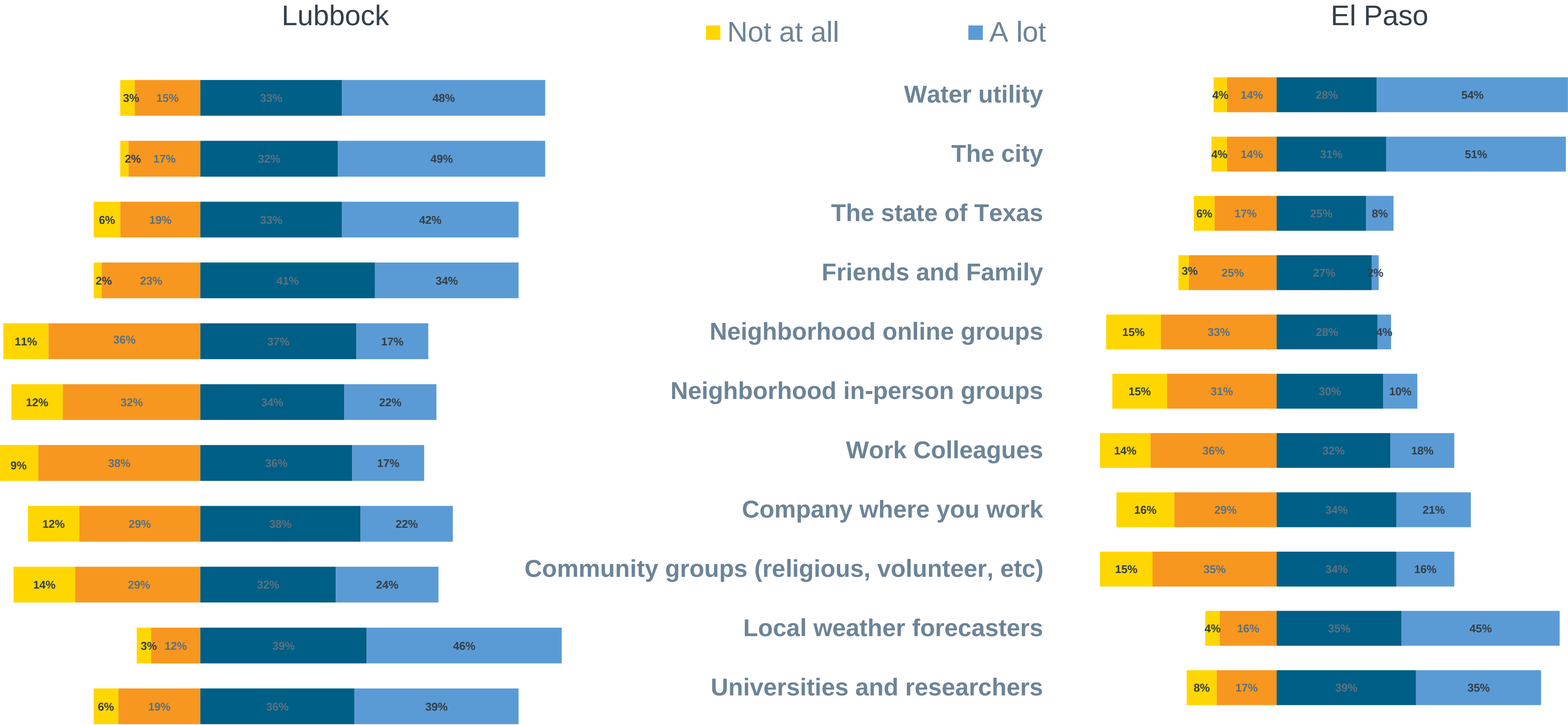
Shifting to Two-Way Communication and Prioritizing Hyperlocal



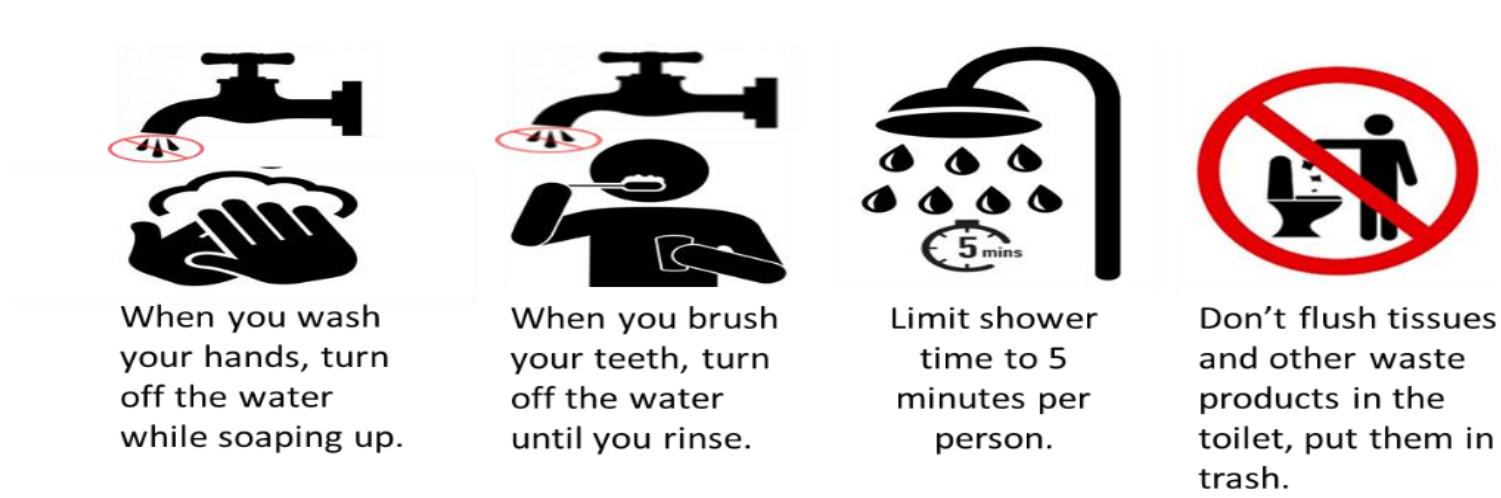
Here is what we think is happening based...



How much would you trust winter preparedness information available from...



Learning about using messages to encourage behavior—what works where?



Water Use Advisory

Message Title
vs. Icon



It's better to be safe than sorry! [English]
Más vale prevenir que lamentar

Cultural Tailoring
(proverb or control)

Please help us prevent such a failure.

The Texas Water Development Board (TWDB) recommends that customers limit their water use by taking the steps below.

Injunctive Norm
(TWDB or control)

You can limit your water use by taking the steps below.

Please join your neighbors in helping to protect water service.
About 3 in 4 of our customers help out by following the TWDB's recommendations.

Descriptive Norm
(neighbors or control)

Please help to protect water service by following these recommendations.

Consider taking these steps to save water. Choose the options that best fit your lifestyle.

Choice Provision
(choice or control)

Take all of these steps to save water. To make a difference you must do all of these.

These steps are voluntary, so the choice to take them is yours. You are free to decide for yourself.

Autonomy
Restoration Script
(Script or control)

It is essential that you do your part in addressing this problem by taking these steps. Your cooperation is appreciated.

Culturally Appropriate Messages— Children as Language Brokers



"I have seen commercials of water tape“

"Tape stops water leaks, but I will not buy one I will cover it with a trash can“

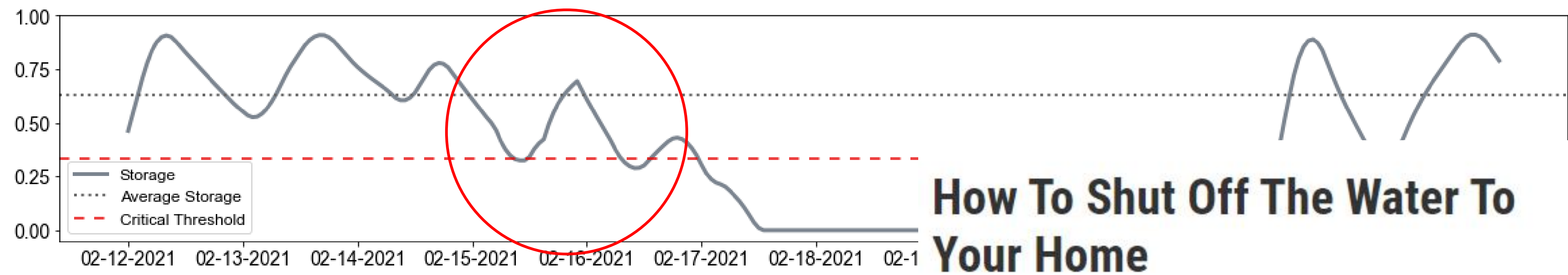
"If they showed a picture, my parents would understand“

"I bring bags full of sand to school in case of floods“

"My parents would just go to the next shop to buy water“

"Flooding floods the streets and you are not able to drive your car, and you will have to prepare and put sandbags everywhere before it gets to your house, you will have to lock the door and put sandbags under the doors so water doesn't get in."

Bringing the systems back under control



How To Shut Off The Water To Your Home

KUT 90.5 | By Nathan Bernier

Published February 3, 2011 at 5:18 PM CST



How we communicate technical information doesn't have to just be through messages...

Water Hauler Graphic Guides

- Designed based on interviews with water truck drivers to fill gap in skills
- Content developed from drivers' expertise and experiences



How we communicate technical information doesn't have to just be through messages...

Refrigerator Magnets for Hauled Customers

- Designed based on feedback from water truck drivers and customers
- Intended to help alleviate some issues related to missed services
- May be helpful for residents new to Bethel who are unfamiliar with hauled responsibilities

BETHEL | WATER DELIVERY

My delivery is: _____

Before each delivery please:

- Move any vehicles blocking the tank



- Move kids' toys and objects blocking driver's path



- Clean up dog waste that might be in driver's path



In the Winter:

- Turn on your sewer tank heater



- Make sure your overflow pipe is not frozen



Members of The American Society of Civil Engineers conduct themselves with integrity and professionalism, and above all else protect and advance the health, safety, and welfare of the public through the practice of Civil Engineering.

Engineers govern their professional careers on the **following fundamental principles**:

- **create safe, resilient, and sustainable infrastructure;**
- treat all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regard to personal identity;
- consider the current and anticipated needs of society; and
- **utilize their knowledge and skills to enhance the quality of life for humanity.**

Engineers:

- a. first and foremost, **protect the health, safety, and welfare of the public;**
- b. enhance the **quality of life** for humanity;
- c. express professional opinions truthfully and only when **founded on adequate knowledge** and honest conviction;
- d. have zero tolerance for bribery, fraud, and corruption in all forms, and report violations to the proper authorities;
- e. endeavor to be of **service in civic affairs;**
- f. **treat all persons with respect, dignity, and fairness**, and reject all forms of discrimination and harassment;
- g. acknowledge the **diverse historical, social, and cultural needs of the community, and incorporate these considerations in their work;**
- h. **consider the capabilities, limitations, and implications of current and emerging technologies** when part of their work; and
- i. report misconduct to the appropriate authorities where necessary to protect the health, safety, and welfare of the public

THANK YOU!

