American Water Works Association

NORTH AMERICAN WATER LOSS 2019

NASHVILLE, TENNESSEE
DECEMBER 3 – 5

Digging Deeper: Using Simple Break and Repair Time Data to Focus Real Water Loss Control

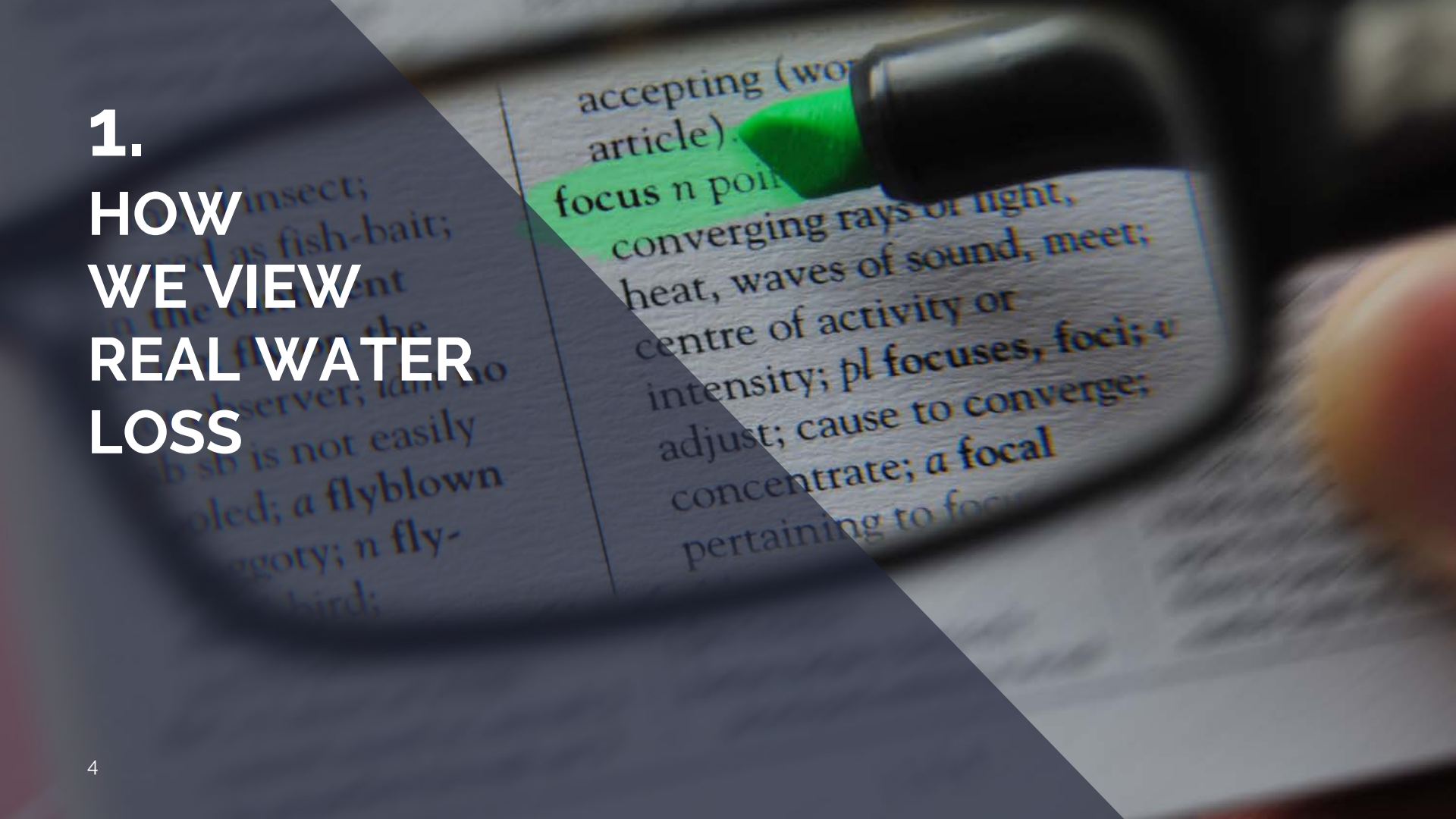
Heather Himmelberger & James Markham, Southwest EFC

We are
Heather Himmelberger
& James Markham

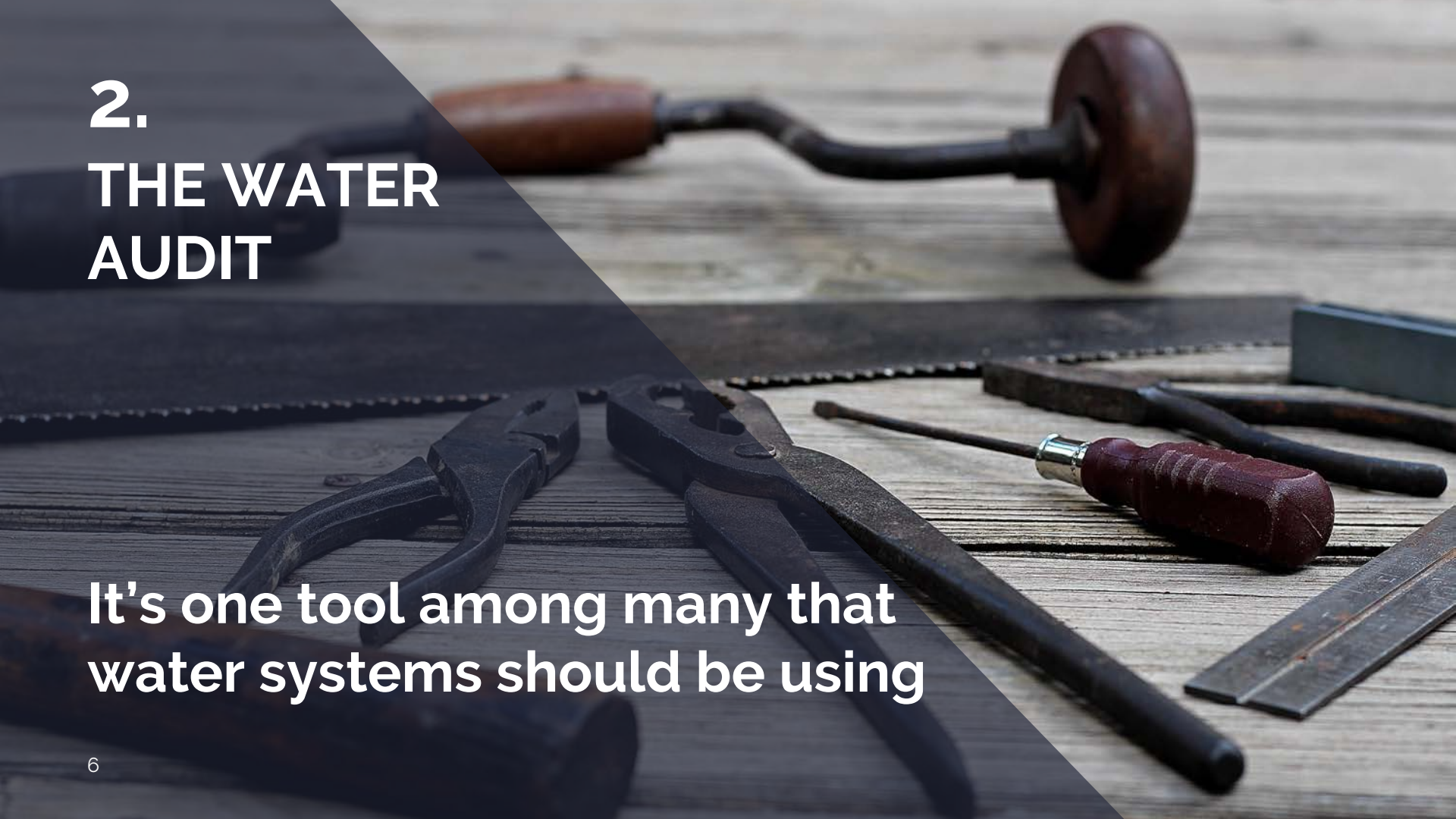
BRI: Break Rate Index

How your system stacks up to the averages

1. HOW WE VIEW REAL WATER LOSS




ASSET
MANAGEMENT

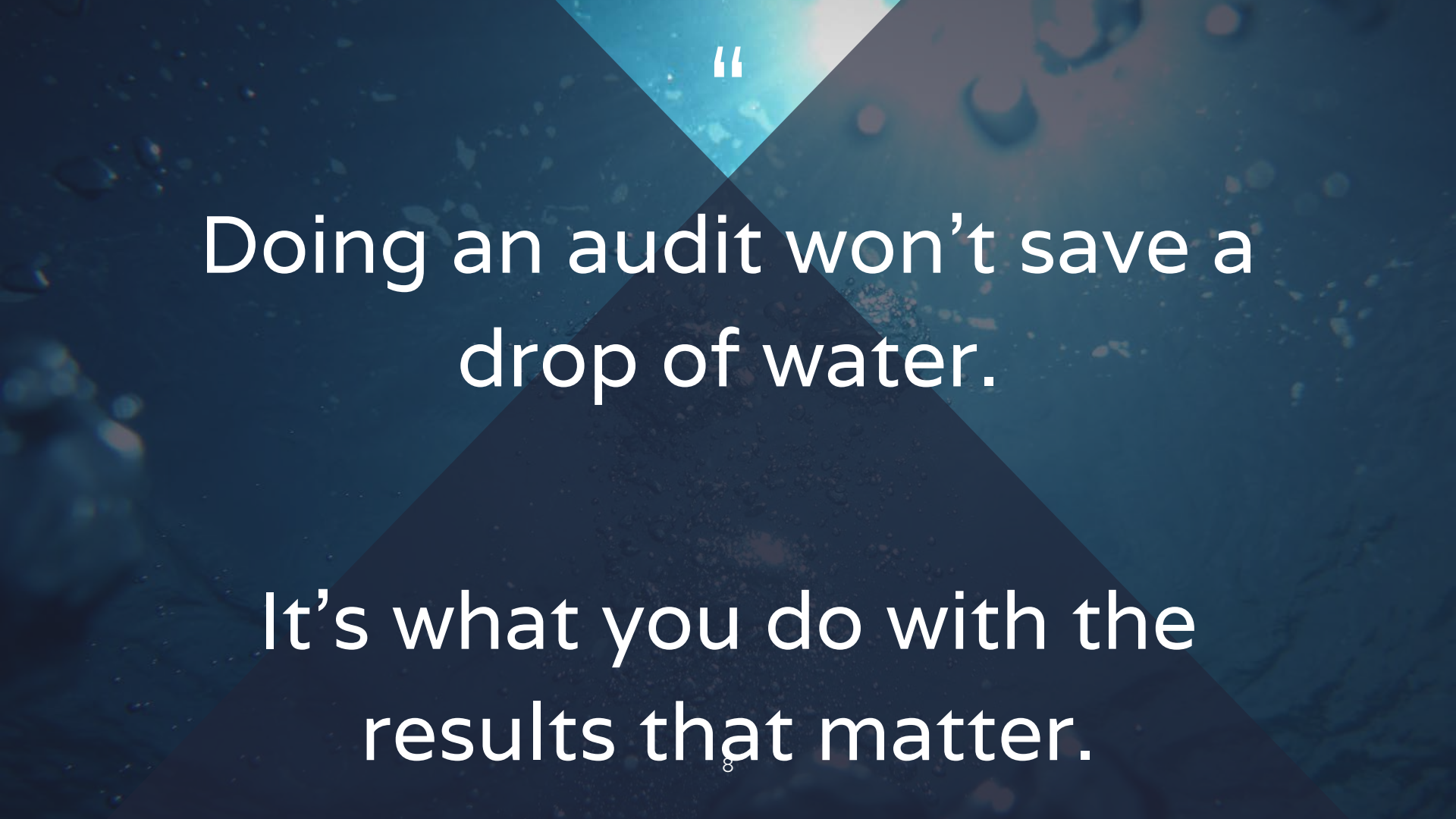


2.
THE WATER AUDIT

It’s one tool among many that water systems should be using

3.
THE WATER AUDIT IS A DIAGNOSTIC TOOL

It estimates real loss magnitude, and gives some guidance about next steps



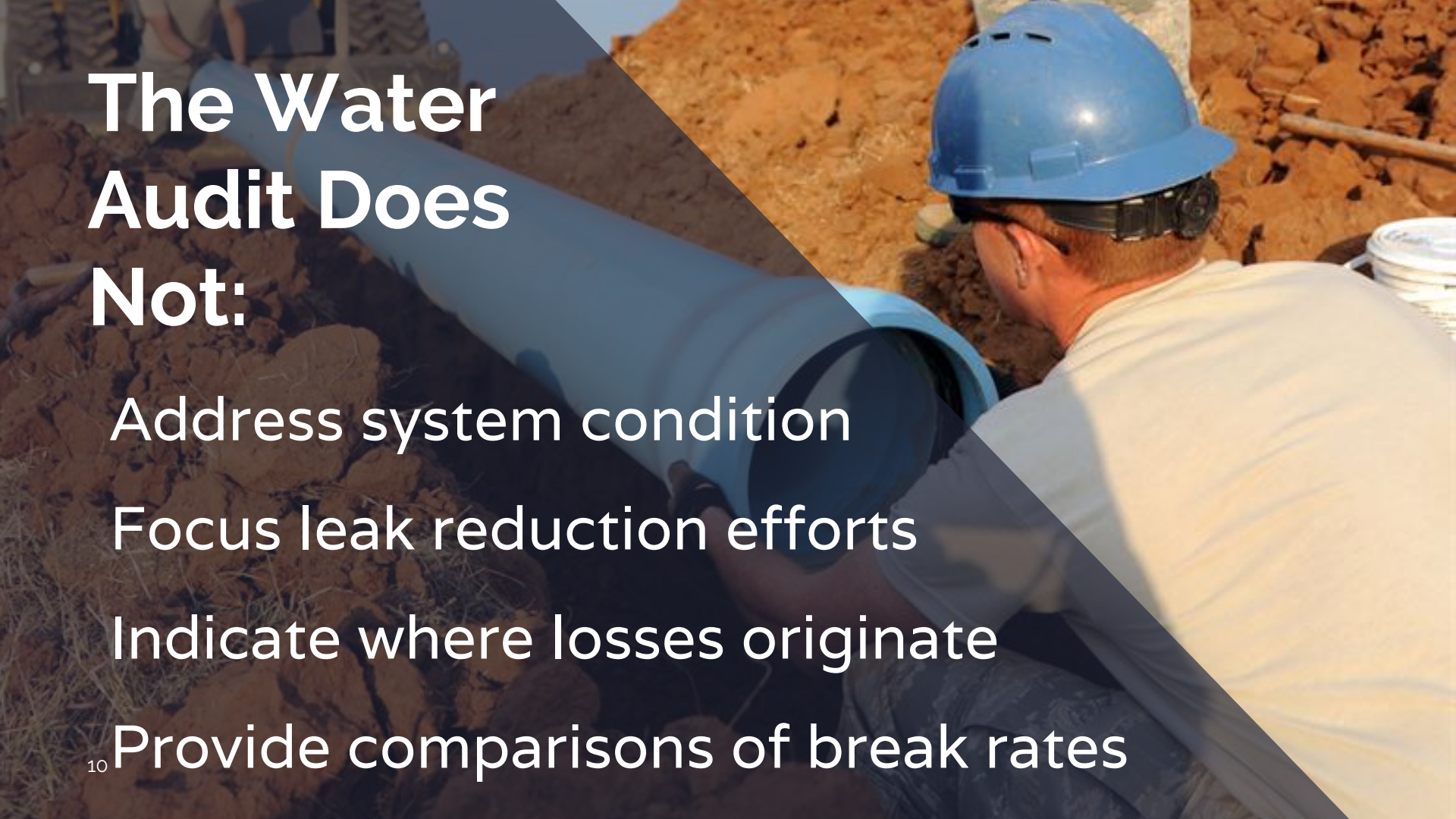
“

Doing an audit won’t save a drop of water.

It’s what you do with the results that matter.

The Audit Estimates:

- Apparent Loss
- Real Loss
- Value of losses (partially)
- A real loss target (sometimes)



The Water Audit Does Not:

- Address system condition
- Focus leak reduction efforts
- Indicate where losses originate
- Provide comparisons of break rates

4.
IT'S BETTER TO HAVE MORE TOOLS …

To do component analysis

To focus your attacks on real loss.

5. REDUCING REAL WATER LOSS

There are limits to what you can do.

YOU CAN:

Reduce pressure

Find and repair breaks faster

Replace leaky pipe

BUT YOU WANT TO DO IT EFFICIENTLY

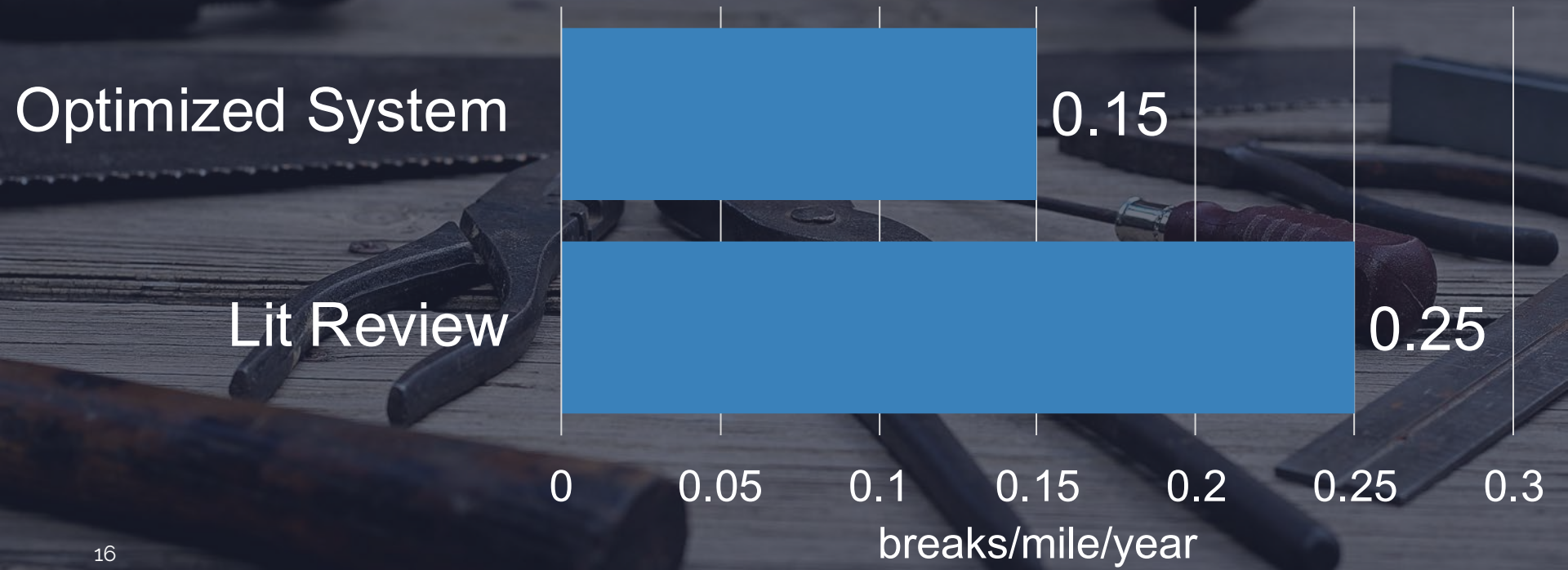
...

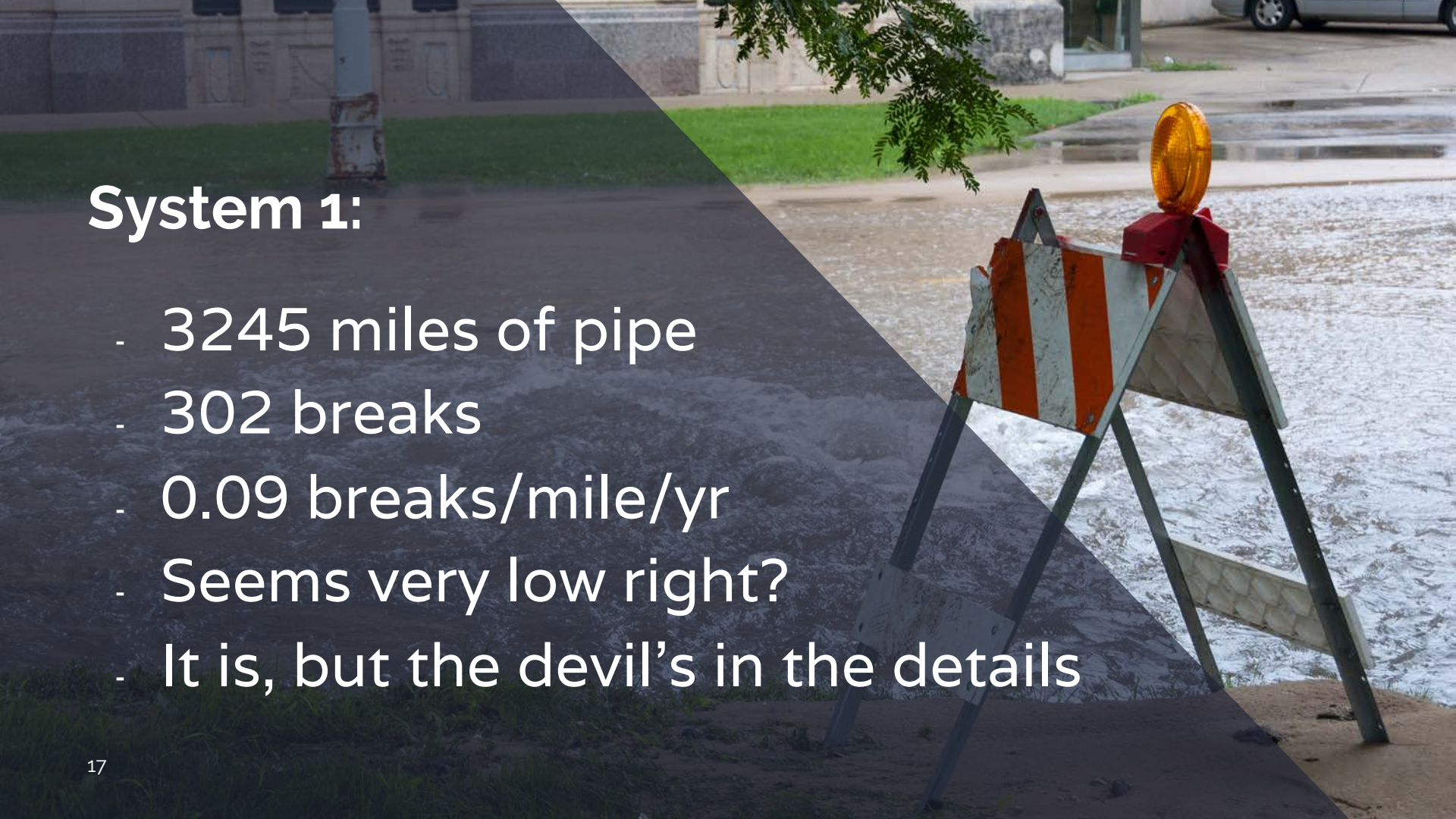
Unfocused efforts can lead to unnecessary expense

System 1:

- 3245 miles of pipe
- 302 breaks
- 0.09 breaks/mile/yr

WRF PROJECT # 4372: Component Analysis





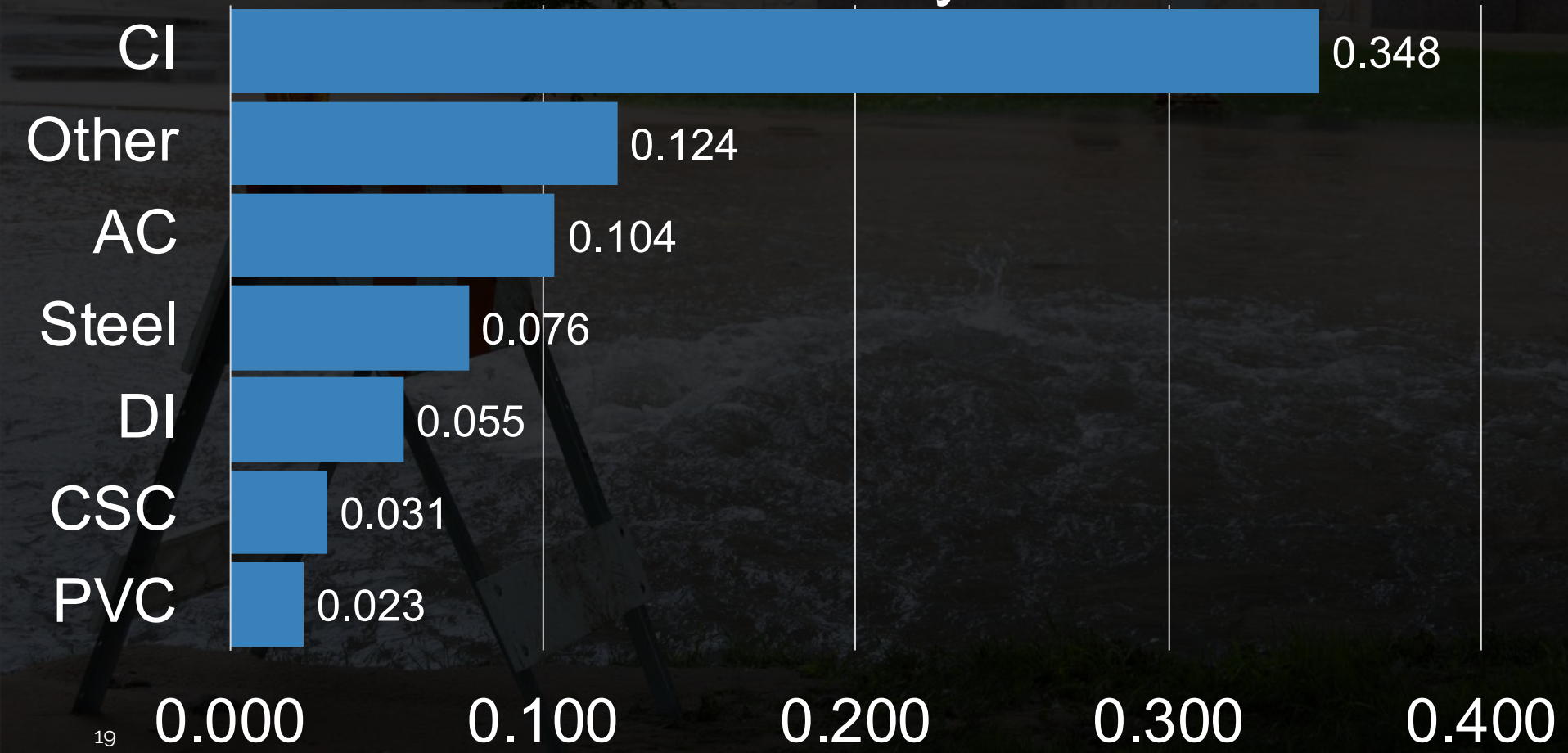
System 1:

- 3245 miles of pipe
- 302 breaks
- 0.09 breaks/mile/yr
- Seems very low right?
- It is, but the devil’s in the details

6.
BUT EVERY SYSTEM HAS A DIFFERENT PIPE MIX

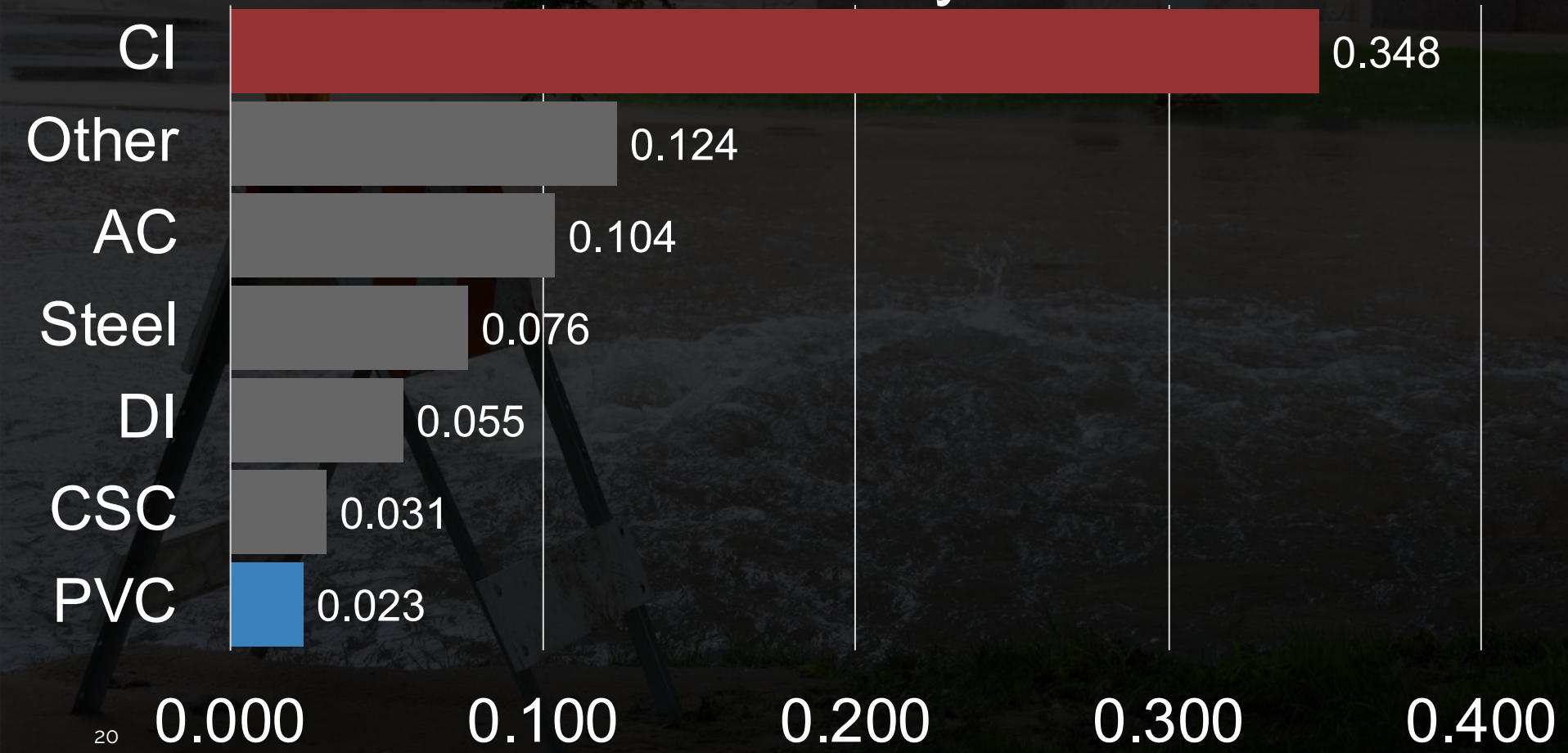
System-wide comparisons may hide important details

2018 Breaks/Mile by Material



(Folkman, 2018)

2018 Breaks/Mile by Material



(Folkman, 2018)

7. THE BRI: A DIMENSIONLESS COMPARISON INDEX

A comparison of your breaks system wide and by material to US/Canadian averages

Introduction

This Break Rate Analysis Tool was developed by the Southwest Environmental Finance Center (SW EFC) to compare annual main breaks from your system to the US/Canadian average break rates for 7 pipe materials published by Dr. Steven Folkman in 2012 and 2018. These studies clearly demonstrate that the average failure rates for different pipe materials vary dramatically, from a low of 2.6 failures/100 miles/year for polyvinyl chloride (PVC) to a high of 34.8 failures/100 miles/year for cast iron (CI) in the most recent study.

This tool uses data you provide about the material makeup of your system and the number of breaks by material to calculate a theoretical, weighted-average break rate for your system based on the study averages – in other words, the break rate for your system if all of the pipe materials were breaking at the US/Canadian averages.

The tool then calculates a "Break Rate Index" (BRI): a non-dimensional index we developed that is simply your system's actual break rate divided by the theoretical weighted average material rate. For example, a system-wide BRI = 1, the system pipes are breaking at the US/Canadian average, a system-wide BRI < 1 means the system is breaking at a rate lower than the US/Canadian average. A system-wide BRI of 2 means that the system-wide, break rate is twice the material-weighted average US/Canadian break rate.

Because we have found that many systems with low overall break rates nevertheless have higher (or lower) than average break rates on [illegible] you present a system-wide BRI, you can also present material specific BRIs. The material specific BRIs are interpreted just like the system-wide BRI. For example, the BRI for CI pipe is 0.5, the break rate of CI pipe in the system is half the US/Canadian average.

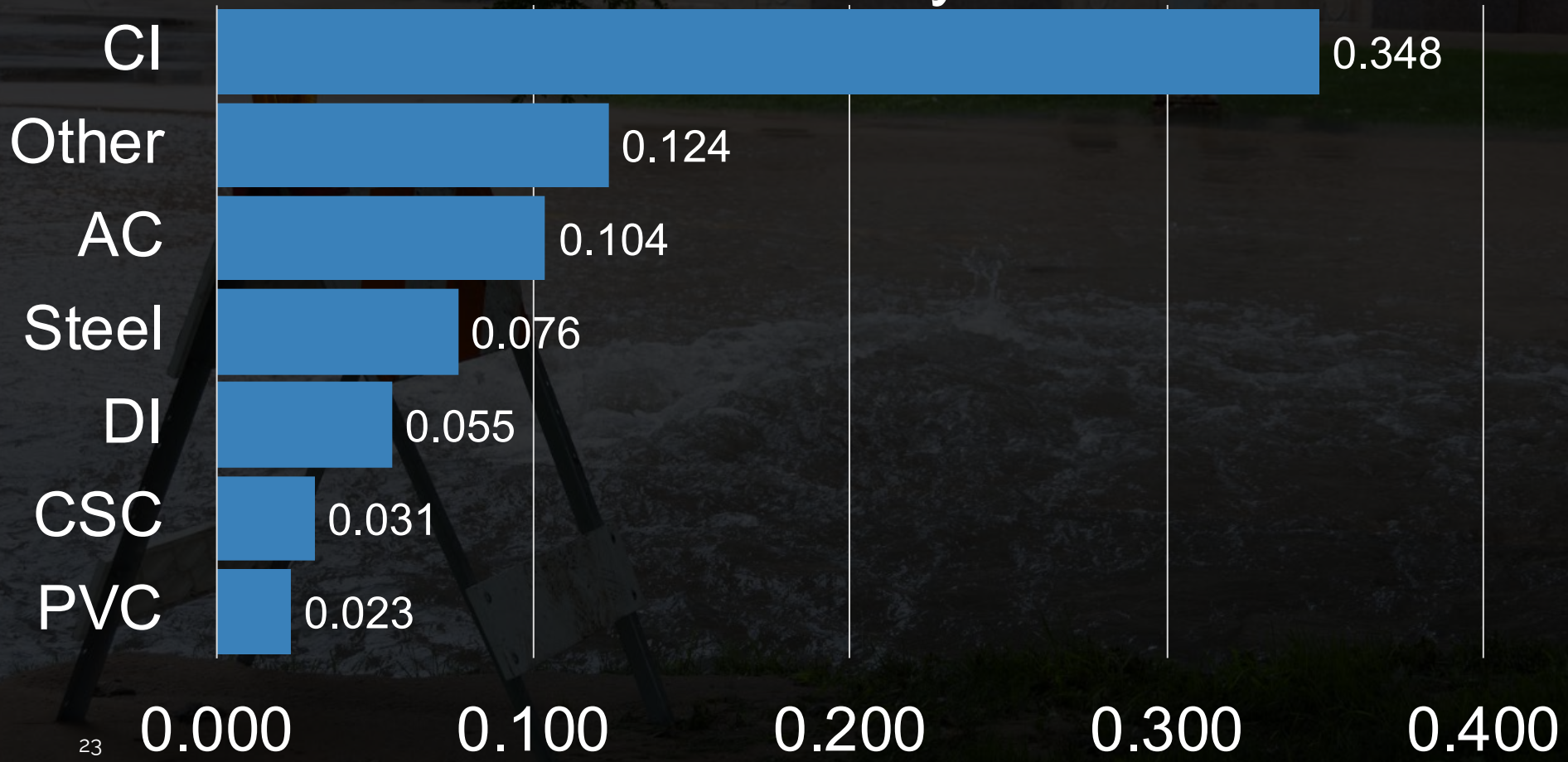
This tool is designed for use by US and Canadian drinking water distribution systems but can be used by any system to compare their [illegible] Total BRI to be < 1 and for certain materials to have material BRIs significantly higher than 1.

Your results will be presented in an easy to real dashboard with a dial gauges displaying the system wide, and material specific BRIs, and a comparison of the percentage of breaks on each material to the percentage of the system that material makes up.

Please note that we are collecting data with this tool for research purposes, namely the entered pipe and break data, size of population served, and the state in which you are located if you submit that information. No IP addresses or other identifying information is collected.

$$Material\ BRI = \frac{\frac{Annual\ \#\ of\ breaks\ for\ pipe\ material}{Miles\ of\ pipe\ material\ in\ system}}{Material\ average\ break\ rate}$$

2018 Breaks/Mile by Material



$$System\ BRI = \left(\frac{Total\ Breaks}{Miles\ of\ Mains}\right) \div WABR$$

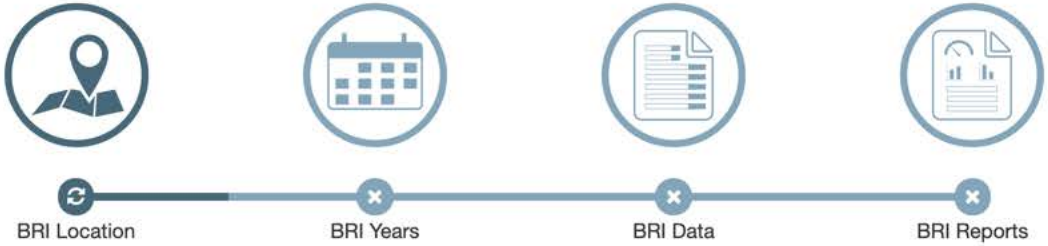
$$WABR\ = system's\ Weighted\ Average\ Break\ Rate$$

$$[(ACBR \times AC) + (CIBR \times CI) + (CSCBR \times CSC) + (DIBR \times DI) + (PVCBR\ \times PVC) + (SBR \times S) + (OBR \times O)]\ \div MM$$

Sample System 1:

- 3245 miles of pipe
- 302 breaks
- 0.09 breaks/mile/yr
- Let’s look a the details

Break Rate Analysis Tool



Introduction

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The tool then calculates a "Break Rate Index" (BRI): a non-dimensional index we developed that is simply your system's actual break rate/mile/year divided by the theoretical, weighted-average material-specific break rate. If a system-wide BRI = 1, the system pipes are breaking at the US/Canadian average. If a system-wide BRI < 1, then the system pipes are breaking at a rate lower than the US/Canadian average. A system-wide BRI of 2 means that the system-wide, break rate is twice the material-weighted average US/Canadian break rate.

Because we have found that many systems with low overall break rates, nevertheless, have higher (or lower) than average break rates on some materials, you will also be presented material-specific BRIs for any pipe materials that you entered. The material specific BRIs are

significantly higher than 1.

Your results will be presented in an easy to real dashboard with a dial gauges displaying the system wide, and material specific BRIs, and a comparison of the percentage of breaks on each material to the percentage of the system that material makes up.

Please note that we are collecting data with this tool for research purposes, namely the entered pipe and break data, size of population served, and the state in which you are located if you submit that information. No IP addresses or other identifying information is collected. If you wish to opt out of data collection you can still use this tool. Simply leave the state/province field blank.

Unit of Measure

Unit of Measure for Pipe Length: Feet

Location

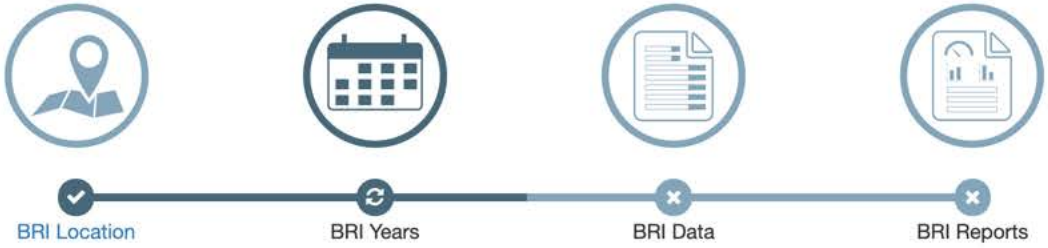
Select your State: New Mexico

*It is not a requirement to provide location information.

From Canada? Switch to Provinces

What size population do you serve?: 100,001 - 1,000,000

Proceed to BRI Year Selection



- [ ] 2009
- [ ] 2010
- [ ] 2011
- [ ] 2012
- [ ] 2013
- [ ] 2014
- [ ] 2015
- [ ] 2016
- [ ] 2017
- [x] 2018
- [ ] 2019

BRI Year Selection

Use the check boxes at the left of the page to determine which years you will be entering data for. You will enter the system material and break data for each year separately. Please enter annual data, not partial years. It does not matter whether you use a calendar year or fiscal year but be consistent, so that you do not over- or under-count breaks. You will enter pipe length and break data by year on the following page(s). You can enter pipe length in either feet or miles.

Once you enter data for a given year you will be prompted to save your BRI record using the button on the lower left of your screen. You can then use the button on the lower right of your screen to proceed to the next year, or the report section if you are done entering data.

Note: BRI values for the years 2009 through 2012 are calculated using the pipe break averages from Dr. Folkman's 2012 study. BRI values for 2018 and beyond use pipe break averages from Dr. Folkman's 2018 study. The BRI values for years 2013 -2017 are calculated using the average values of the two studies.

Proceed to BRI Data Input

BRI Data Entry

2018

Material	Length in Feet		Number of Breaks	
Asbestos Cement	2003812.8	ft	29	breaks
Cast Iron	5450974.29	ft	163	breaks
Concrete	1083234.67	ft	2	breaks
Ductile Iron	738235.66	ft	5	breaks
PCV	7549195.2	ft	36	breaks
Steel	245232.26	ft	63	breaks
Other	63945.21	ft	4	breaks

Select Year of Interest 2018

BRI Year: 2018

Understanding the BRI Gauges

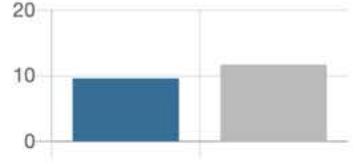
Asbestos Cement	Cast Iron	Concrete	Ductile Iron
			
BRI Score: 0.73	BRI Score: 0.45	BRI Score: 0.31	BRI Score: 0.65

PVC	Steel	Other	Total
			
BRI Score: 1.09	BRI Score: 17.85	BRI Score: 2.66	BRI Score: 0.67

Select Year of Interest 2018

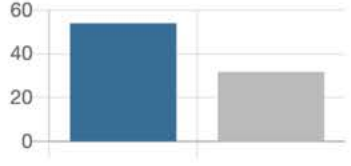
Understanding the BRI Bar Charts

Asbestos Cement



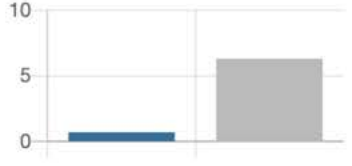
9.6% of Main Breaks
11.7% of System Mains

Cast Iron



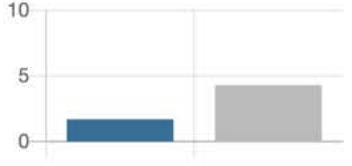
54% of Main Breaks
31.8% of System Mains

Concrete



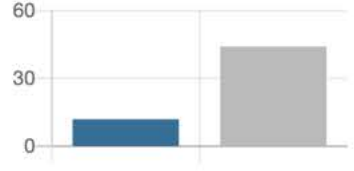
0.7% of Main Breaks
6.3% of System Mains

Ductile Iron



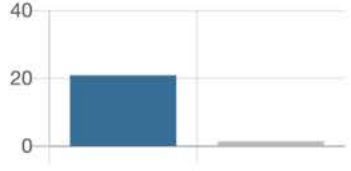
1.7% of Main Breaks
4.3% of System Mains

PVC



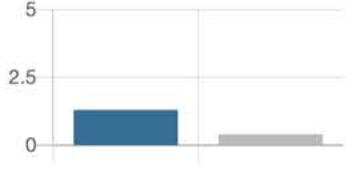
11.9% of Main Breaks
44.1% of System Mains

Steel



20.9% of Main Breaks
1.4% of System Mains

Other

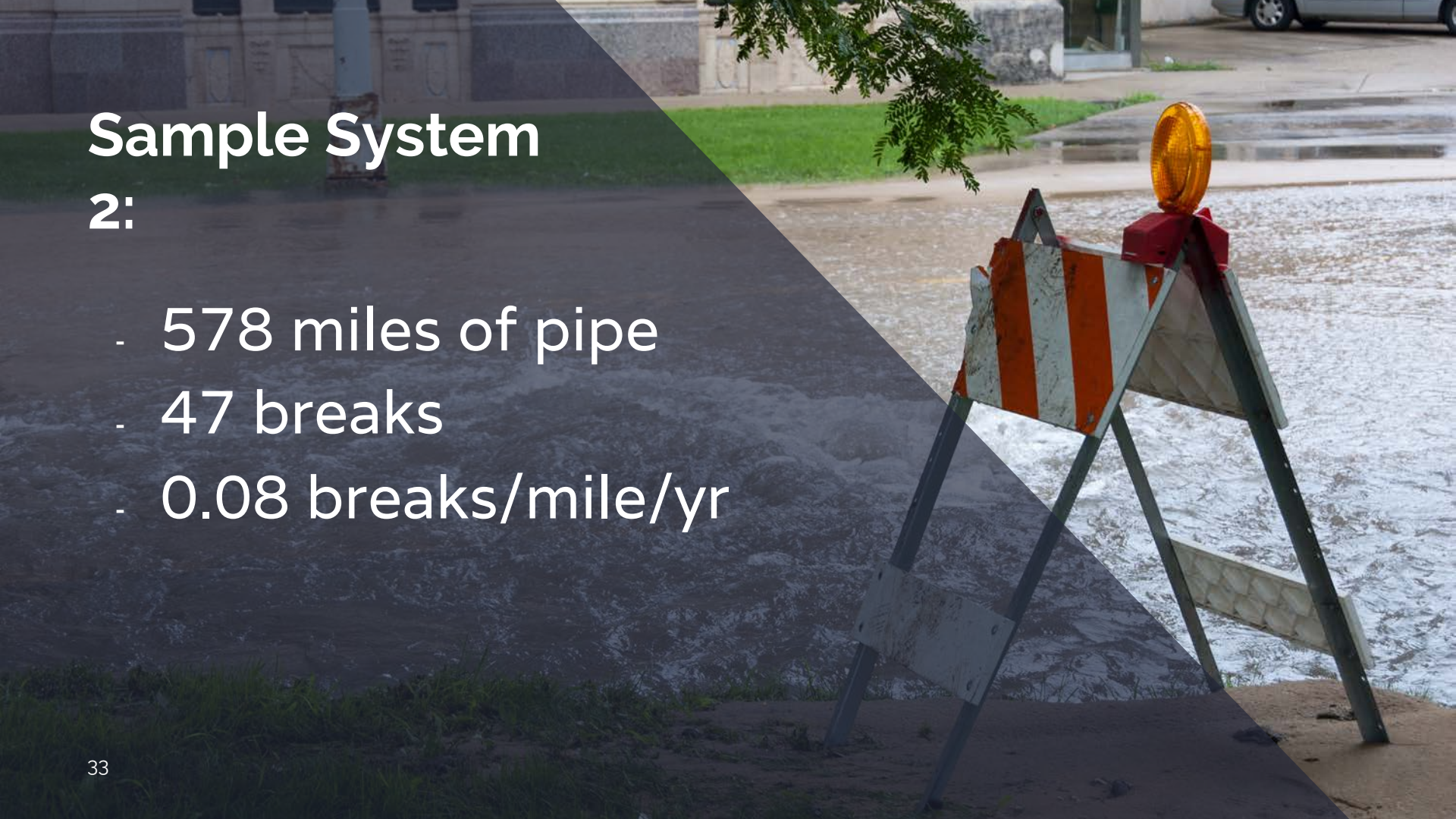


1.3% of Main Breaks
0.4% of System Mains

Select Year of Interest 2018

Understanding the BRI Summary Table

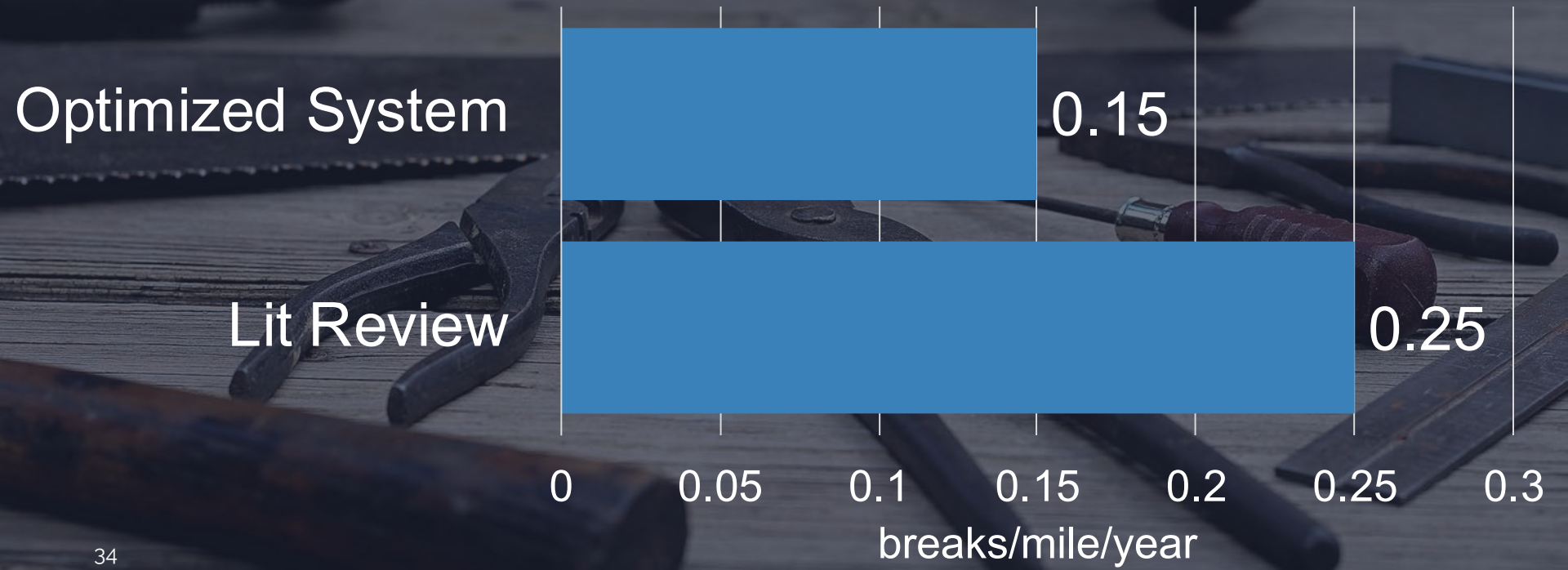
Material	Feet of Pipe	Miles of Pipe	Percent of System	Total Number of Breaks	Percent of Breaks	Breaks per Mile	US/Canadian Average Breaks per Mile	Theoretical Breaks	BRI
Asbestos	2003792.14	379.51	11.7	29	9.6	0.08	0.1	39	0.73
Cast Iron	5450974.29	1032.38	31.8	163	54	0.16	0.35	359	0.45
Concrete	1083234.67	205.16	6.3	2	0.7	0.01	0.03	6	0.31
Ductile Iron	738235.66	139.82	4.3	5	1.7	0.04	0.06	8	0.65
PVC	7549195.2	1429.77	44.1	36	11.9	0.03	0.02	33	1.09
Steel	245232.26	46.45	1.4	63	20.9	1.36	0.08	4	17.85
Other	63945.21	12.11	0.4	4	1.3	0.33	0.12	2	2.66
Totals	17134609.43	3245.2	100	302	100	0.09	0.14	451	0.67



Sample System 2:

- 578 miles of pipe
- 47 breaks
- 0.08 breaks/mile/yr

WRF PROJECT # 4372: Component Analysis



BRI Data Entry

2016

Material	Length in Feet	Number of Breaks
Asbestos Cement	21210 ft	0 breaks
Cast Iron	9402.53 ft	0 breaks
Concrete	0.00 ft	0 breaks
Ductile Iron	125894.25 ft	0 breaks
PCV	2897533.47 ft	47 breaks
Steel	0.00 ft	0 breaks
Other	0.00 ft	0 breaks

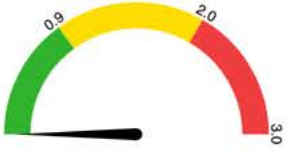
Save 2016 BRI Record

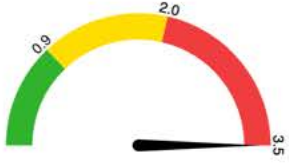
Proceed to Reports

Select Year of Interest 2016

BRI Year: 2016

Understanding the BRI Gauges

Asbestos Cement	Cast Iron	Concrete	Ductile Iron
			
BRI Score: 0	BRI Score: 0	BRI Score: 0	BRI Score: 0

PVC	Steel	Other	Total
			
BRI Score: 3.5	BRI Score: 0	BRI Score: 0	BRI Score: 3.02

Select Year of Interest 2016

Understanding the BRI Bar Charts

Asbestos Cement

0% of Main Breaks
0.7% of System Mains

Cast Iron

0% of Main Breaks
0.3% of System Mains

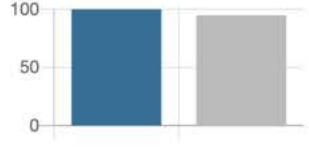
Concrete

0% of Main Breaks
0% of System Mains

Ductile Iron

0% of Main Breaks
4.1% of System Mains

PVC



100% of Main Breaks
94.9% of System Mains

Steel

0% of Main Breaks
0% of System Mains

Other

0% of Main Breaks
0% of System Mains

0% of System Mains 0% of System Mains

Select Year of Interest 2016

Understanding the BRI Summary Table

Material	Feet of Pipe	Miles of Pipe	Percent of System	Total Number of Breaks	Percent of Breaks	Breaks per Mile	US/Canadian Average Breaks per Mile	Theoretical Breaks	BRI
Asbestos	21210	4.02	0.7	0	0	0	0.09	0	0
Cast Iron	9402.53	1.78	0.3	0	0	0	0.3	1	0
Concrete	0	0	0	0	0	0	0.04	0	0
Ductile Iron	125894.25	23.84	4.1	0	0	0	0.05	1	0
PVC	2897533.47	548.78	94.9	47	0	0.09	0.02	13	3.5
Steel	0	0	0	0	0	0	0.11	0	0
Other	0	0	0	0	0	0	0.17	0	0
Totals	3054040.25	578.42	100	47	0	0.08	0.03	15	3.02

8.

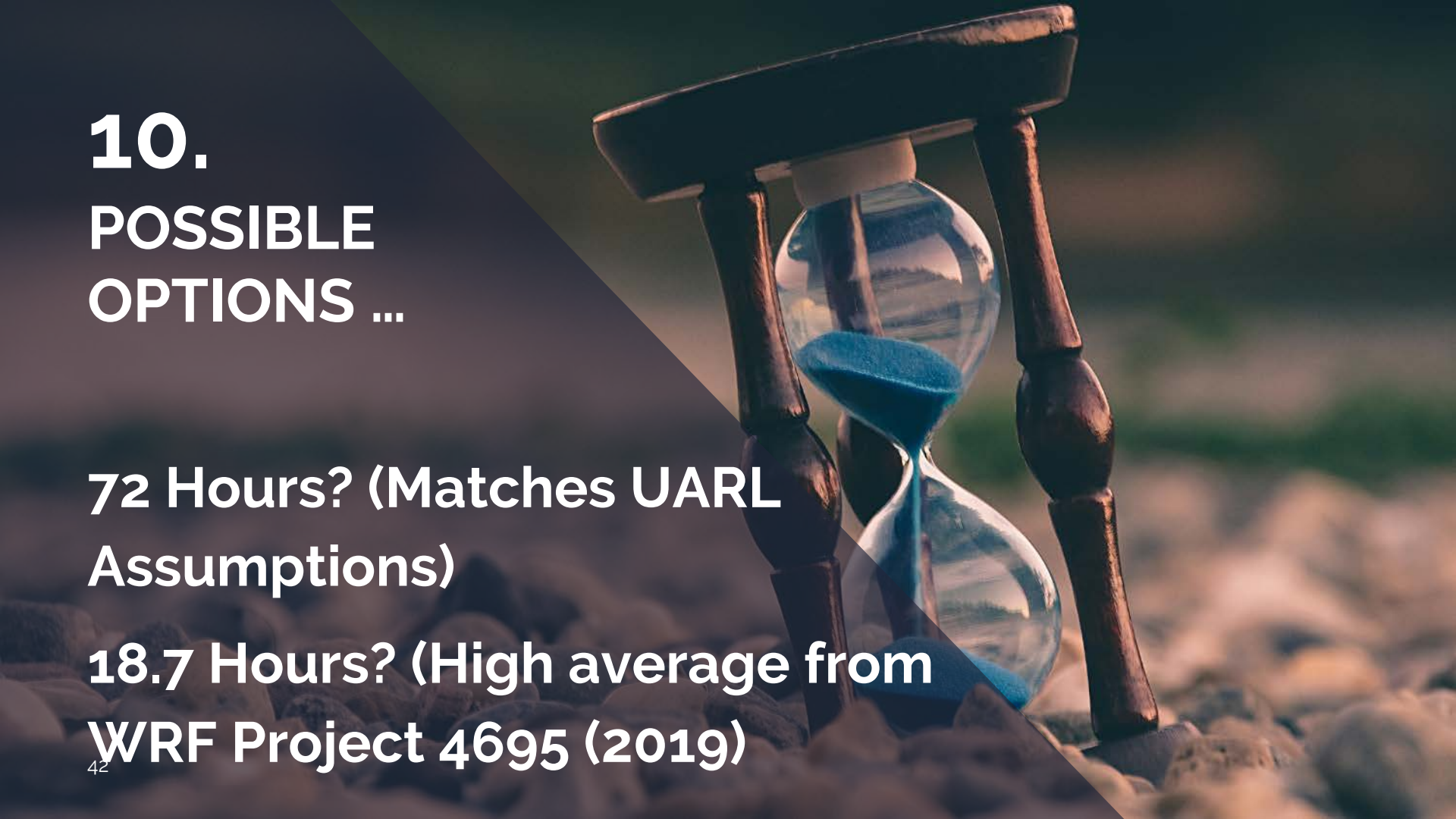
THE RTI: REPAIR TIME INDEX

How do your repair times stack up to best practices?

$$RTI = \frac{Average\ Repair\ Time}{Repair\ Time\ Standard}$$

9.
HOLD YOUR HORSES – WHAT'S THE STANDARD?

10.
POSSIBLE OPTIONS …



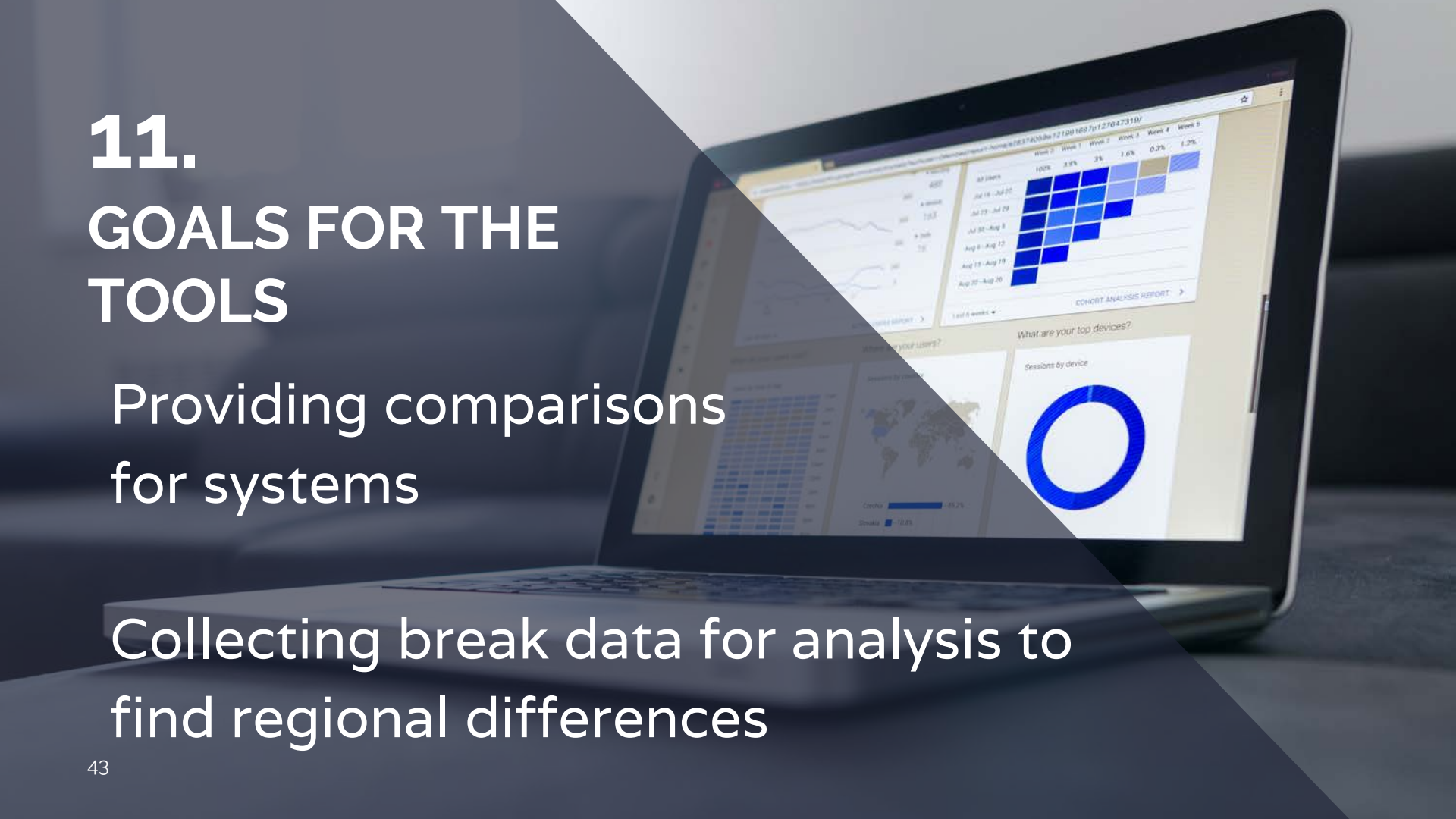
72 Hours? (Matches UARL Assumptions)

18.7 Hours? (High average from WRF Project 4695 (2019)

11.
GOALS FOR THE TOOLS

Providing comparisons for systems

Collecting break data for analysis to find regional differences



HELPING STAKEHOLDERS UNDERSTAND YOUR SYSTEM

BRI results are easy to interpret

Select Year of Interest 2018

BRI Year: 2018

Understanding the BRI Gauges

Asbestos Cement	Cast Iron	Concrete	Ductile Iron
			
BRI Score: 0.73	BRI Score: 0.45	BRI Score: 0.31	BRI Score: 0.65

PVC	Steel	Other	Total
			
BRI Score: 1.09	BRI Score: 17.85	BRI Score: 2.66	BRI Score: 0.67

SOUTHWEST ENVIRONMENTAL FINANCE CENTER

Heather: heatherh@unm.edu
James: jmarkham@unm.edu

EFC Website: southwestefc.unm.edu
Application Server: swefcapps.unm.edu