NATIONAL GOVERNORS ASSOCIATION

2018 Water Policy Institute

September 11 - 12, 2018

National Governors Association
Center for Best Practices

NATIONAL GOVERNORS ASSOCIATION

Opening Remarks

Sue Gander, Director, Environment, Energy, & Transportation,
National Governors Association Center for Best Practices

NATIONAL GOVERNORS ASSOCIATION

Welcome Remarks

The Honorable Edmund G. 'Jerry' Brown

Governor of California

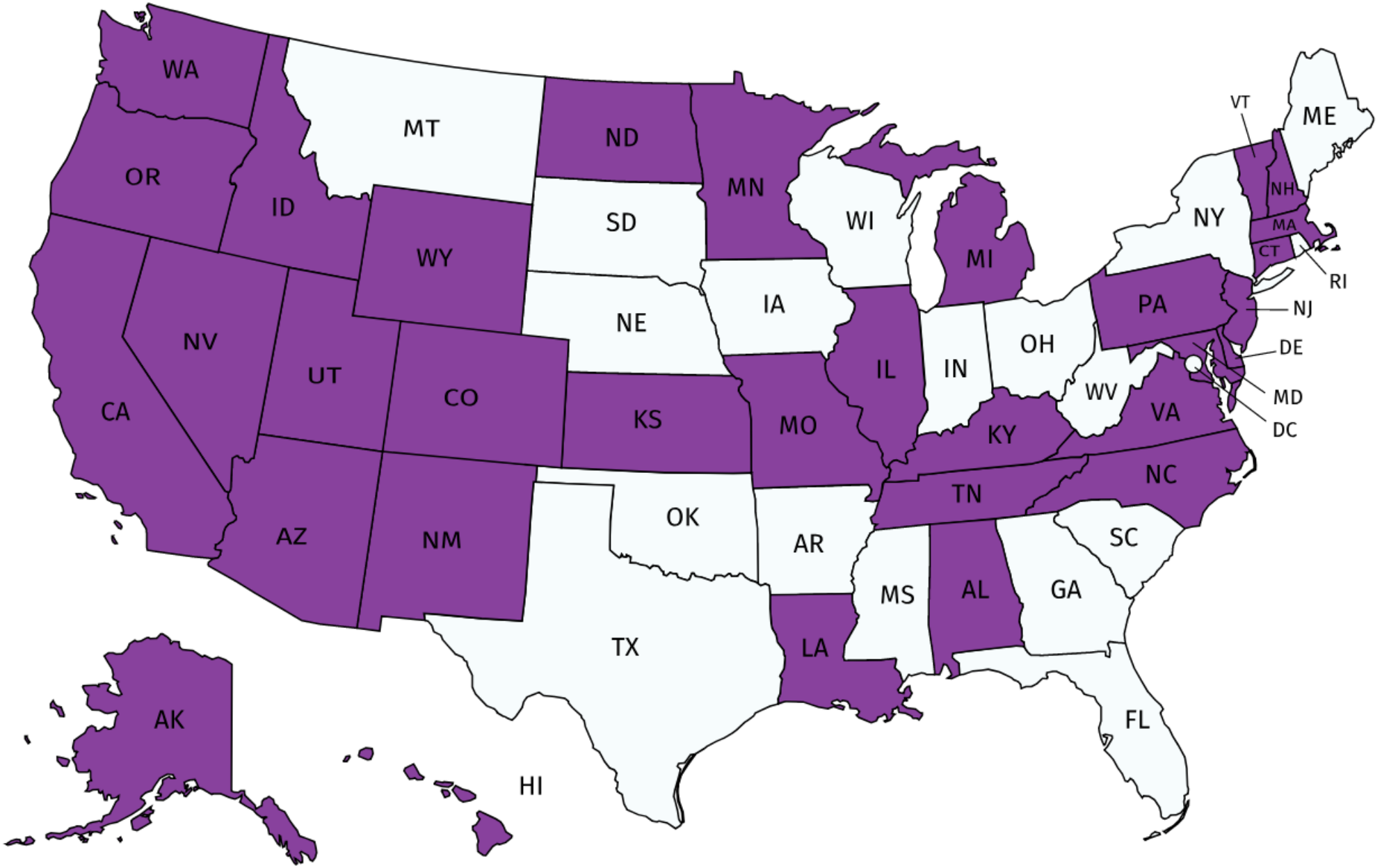
Co-Chair, National Governors Association Water Policy Learning Network

NATIONAL GOVERNORS ASSOCIATION

State Introductions

Bevin Buchheister, National Governors Association

Introduce yourself, a key water policy issue you have worked on, and one issue you'd like to learn more about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NATIONAL GOVERNORS ASSOCIATION

Transforming the Water Sector Through Technology & Innovation

Albert Cho

Vice President of Strategy & Business Development

Xylem, Inc.

Transforming Water through Technology and Innovation

National Governors Association Water Policy Institute

September 11, 2018

Xylem – a global water technology company based in New York

WE ARE A WATER INDUSTRY LEADER WITH GLOBAL REACH …

- Leading global water technology provider
- Approximately 16,800 global employees
- Headquarters: Rye Brook, NY; ~350 global locations
- Doing business in 150+ countries on 6 continents
- $4.7 billion in combined sales in 2017

…UNIQUELY POSITIONED TO HELP OUR PARTNERS SOLVE THE WORLD'S WATER CHALLENGES

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Advanced Infrastructure Analytics to transform water management

Who we are

A new platform of **disruptive technologies** to help water utilities substantially reduce capital and operating costs by eliminating waste

What we do

We use **data analytics** to help utilities monitor, optimize and control condition and performance of water and wastewater networks

Our impact

We create **outsize economic and social benefits**, reducing non-revenue water and sewer overflows, and cutting capital and operating costs through predictive analytics and design optimization

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Addressing water as a national security challenge

Four taps: a national solution

- Water catchments
- Water imports
- Reclaimed water
- Desalination

Could water be the issue that defines a leader's legacy?

1. Is the problem material?

2. Do people care?

3. Can anything be done?

Transforming water with technology

- **The call to action**
- **Transformation opportunity**
- **What leaders can do**

Image credit: WaterCanada

Vital signs: Our infrastructure is failing

30 percent non-revenue water

240 thousand water main breaks

850 billion gallons of raw sewage released

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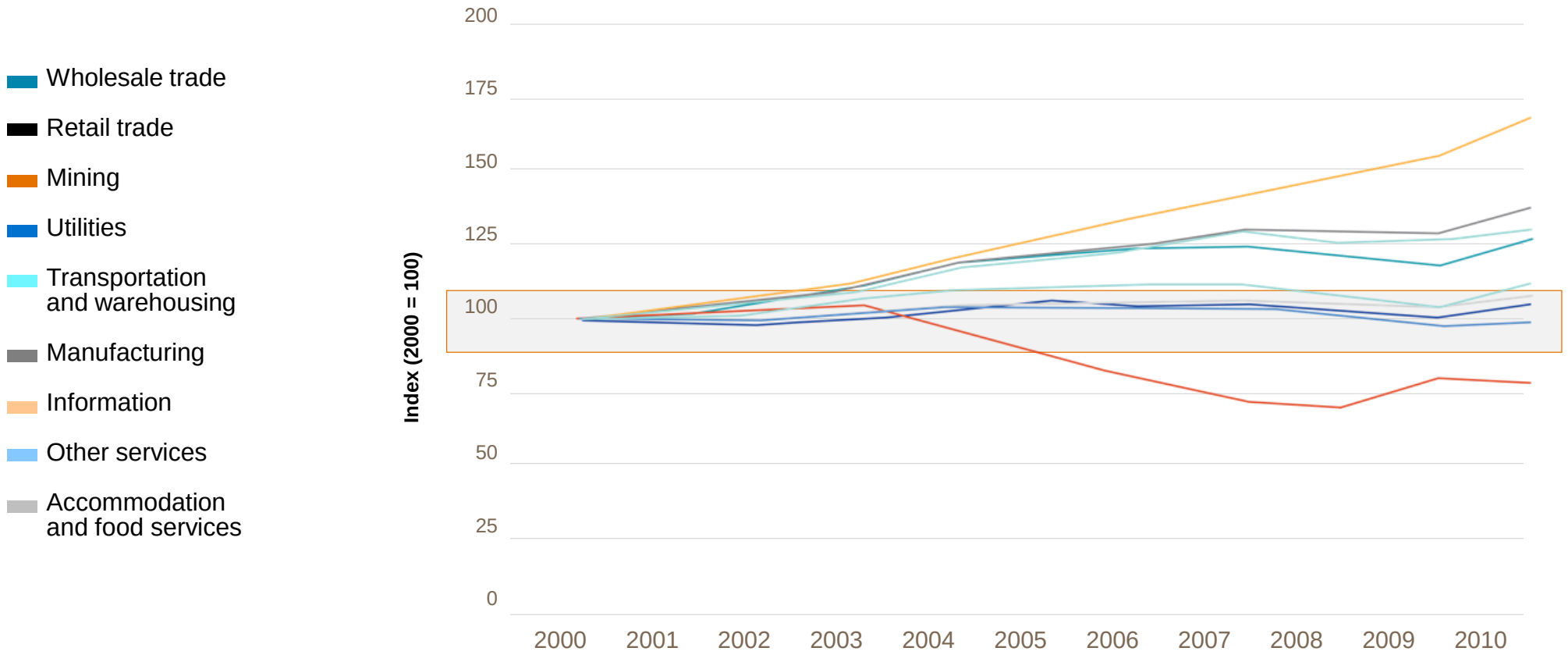
Utilities are no more productive today than they were in 2000

Changes in output per hour by sector, 2000–2010



Source: NewWorld Capital Partners, US Bureau of Labor Statistics

Source: NewWorld Capital Partners, US Bureau of Labor Statistics

Meanwhile, America is facing a water affordability challenge

	2014 Water Rates	6% Rate Increase	41% Rate Increase
Annual water bill	$1,440	$1,526.40	$2,030.40
Minimum annual income to afford water bill	$32,000	$33,920	$45,120
Percent of households below affordability benchmark	11.9%	14.7%	**35.6%**

RESEARCH ARTICLE

A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States

Elizabeth A. Mack, Sarah Wrase

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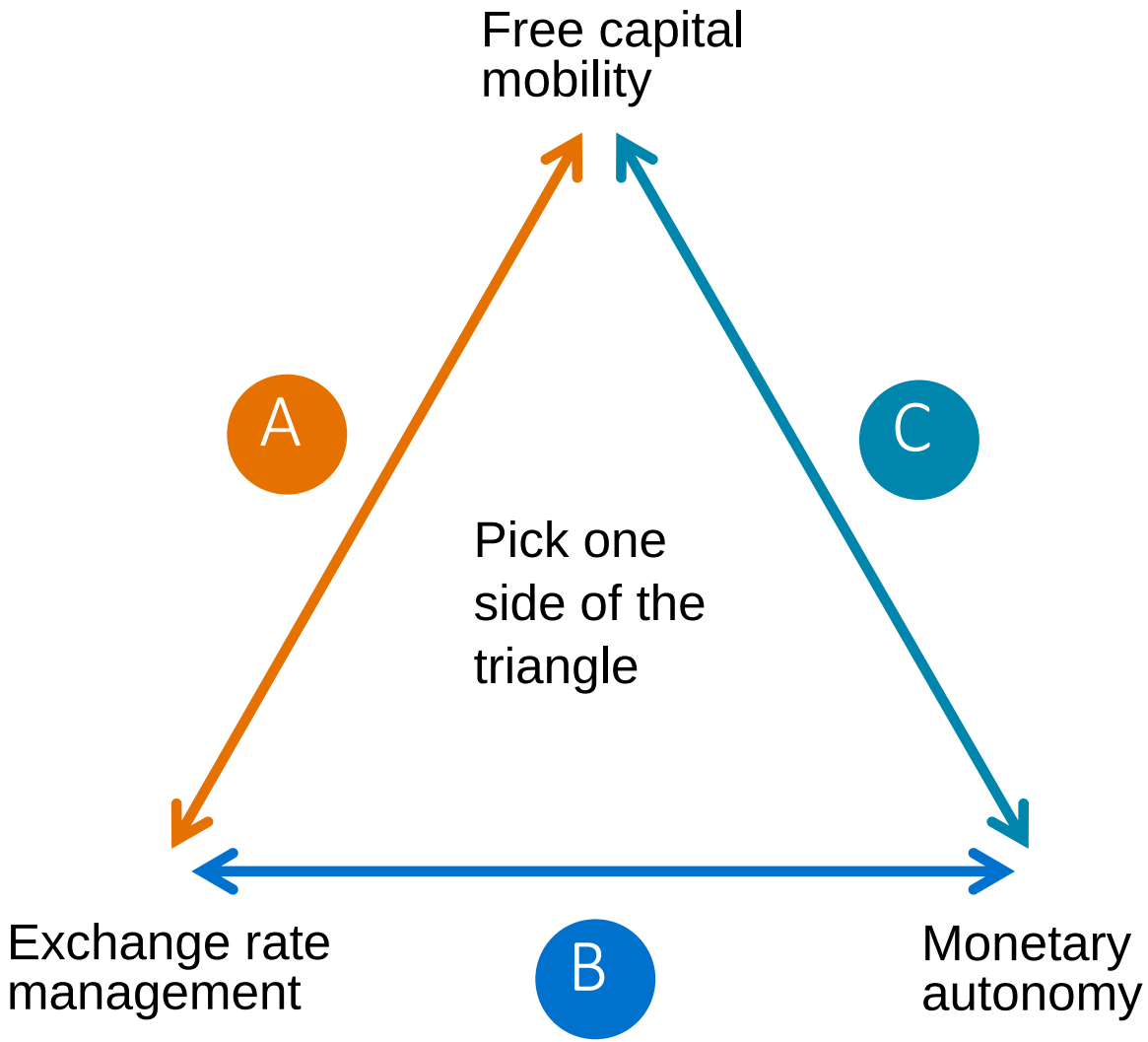
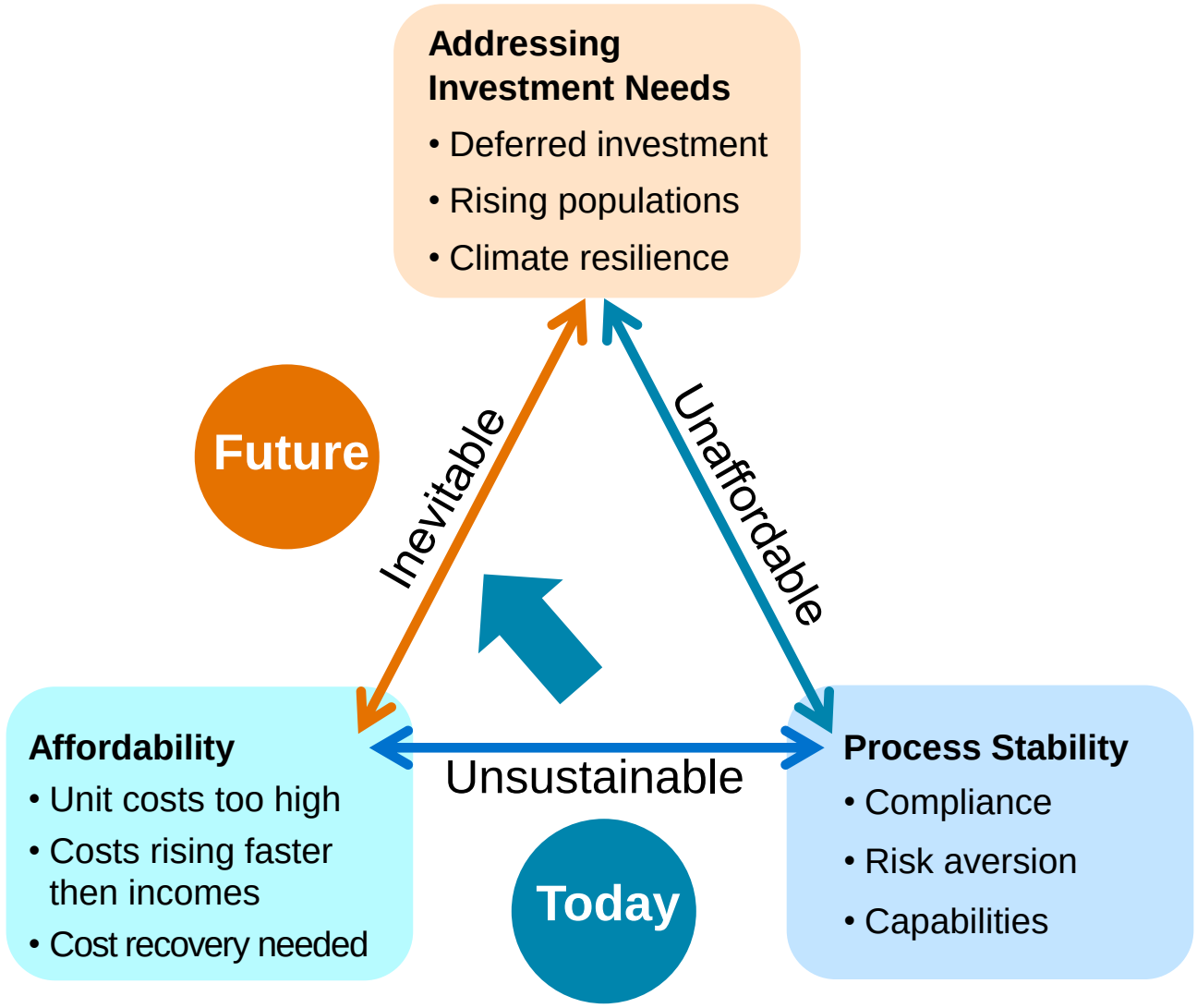
Pick Two: The policy trilemma of international macroeconomics



Source: Economist

We have a policy trilemma too!



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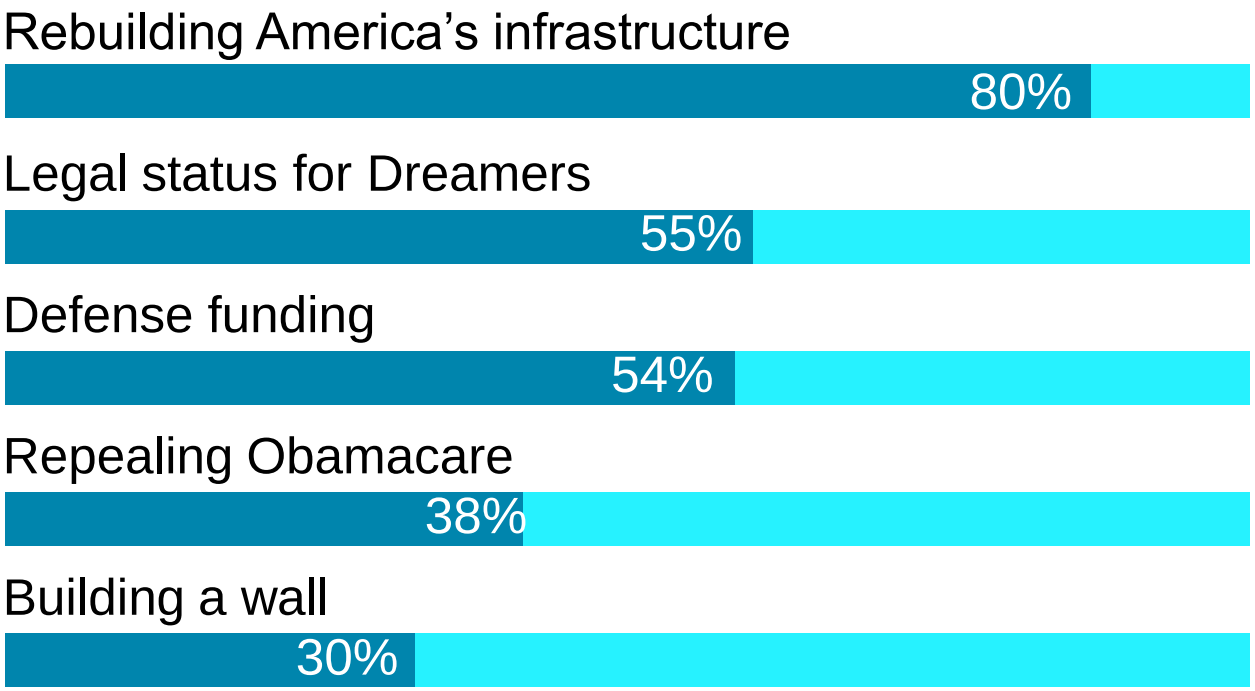
Support for investment in water infrastructure is strong

Third Annual Value of Water Index



80%

Of Americans say investing in water infrastructure is more important than every other top Federal issue right now

Value of Water CAMPAIGN

thevalueofwater.org

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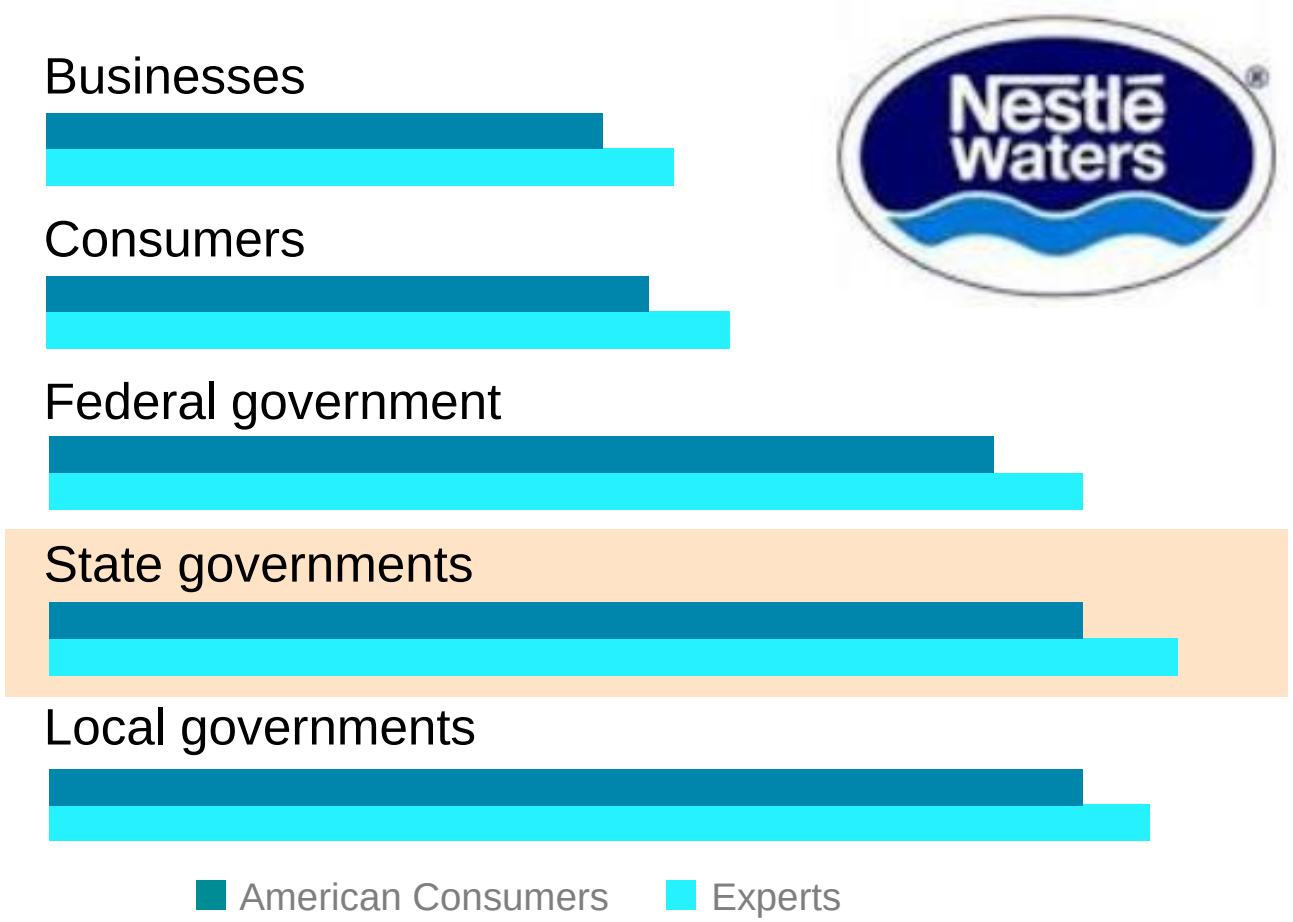
The public wants state governments to act



Americans expect governments at all levels, businesses and a range of other entities to ensure access to clean drinking water – **but states face the highest expectations**

Transforming water with technology

- The call to action
- **Transformation opportunity**
- What leaders can do

Image credit: WaterCanada

There are several sources of transformative potential in water

	Description	Example
Gains from Trade	• Exchanges between entities with different cost structures creates value	• NYC Watershed Agreement • Nutrient trading • Bubble permits
Economies of Scale and Scope	• Fixed costs can be spread across larger organizations to increase productivity	• Vertical or horizontal integration
Technology and Innovation	• Changes in technology can materially increase an entity's productivity	• Avoidance of capital or operating expense

Focus of today's discussion

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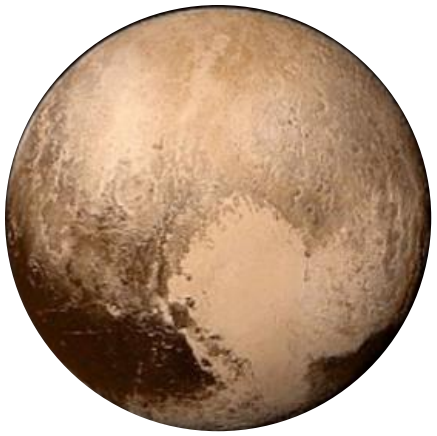
A decade is a long time



There is no state with a democracy except Libya on the whole planet.
—Muammar al-Gaddafi

2006 2007 2009 2011

Open to public

NETFLIX

UBER

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Let's Solve Water

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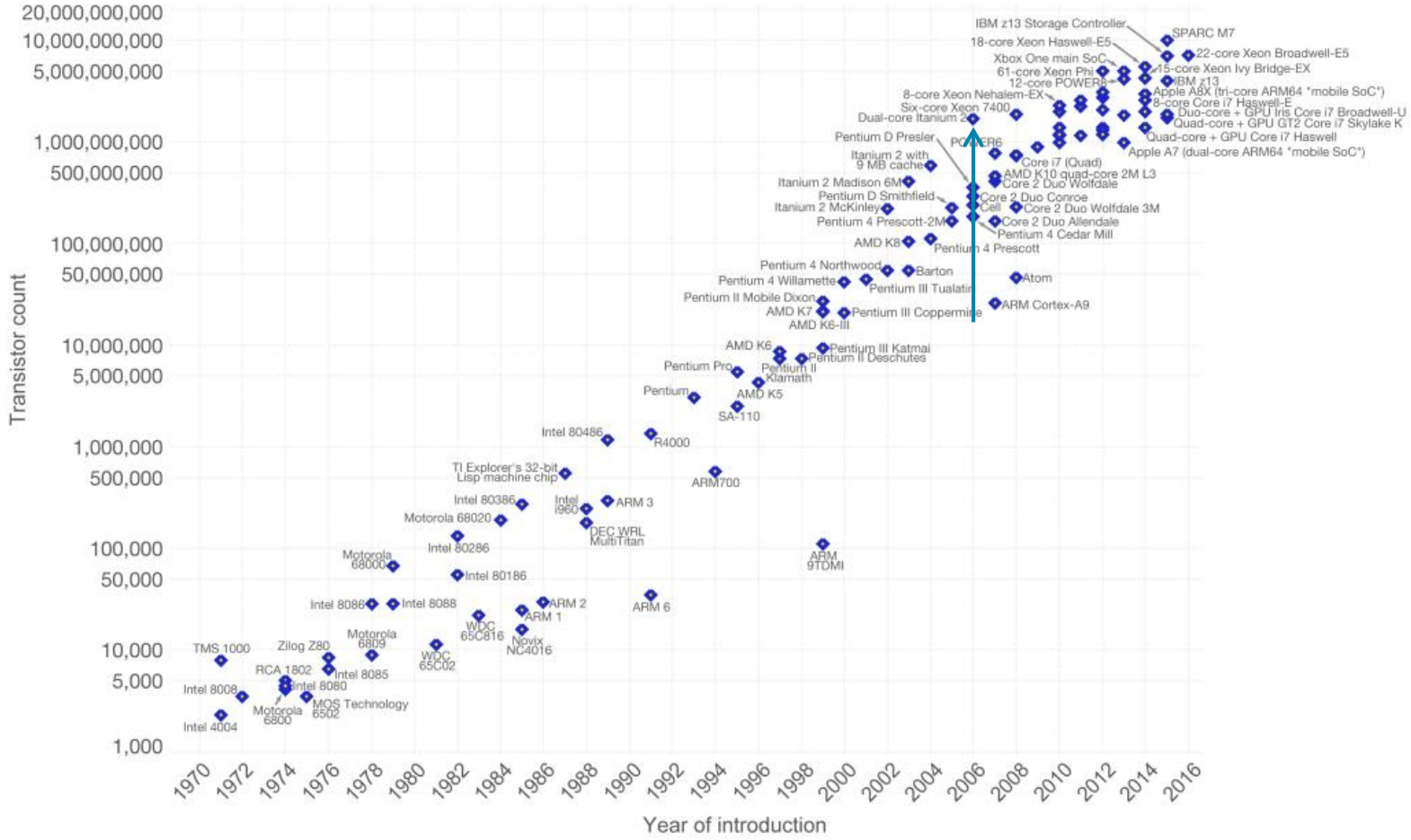
Changes in 12 years: Computing

40X



Source: Brookings, Wikimedia

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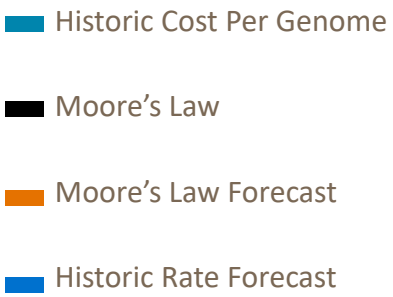
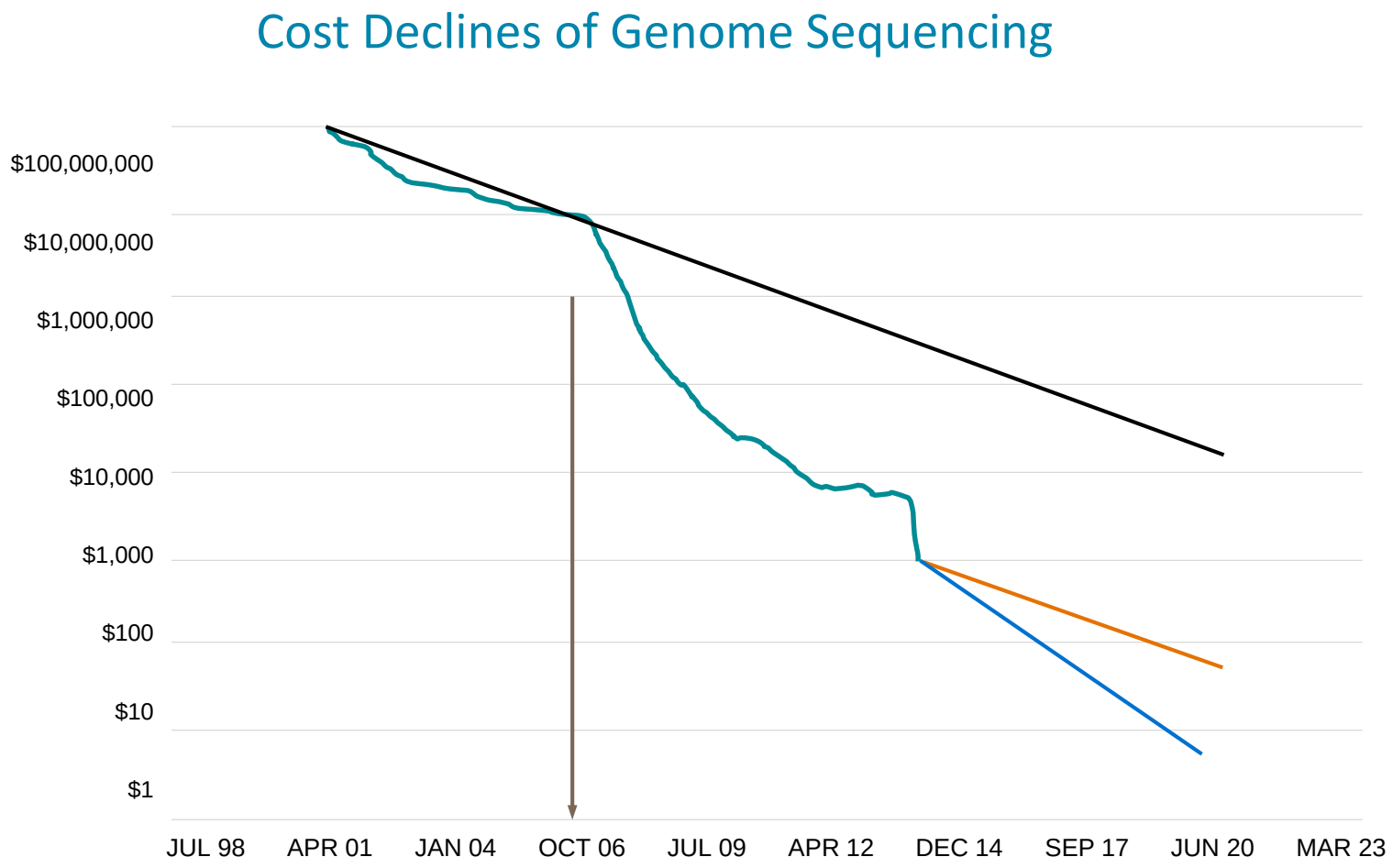
Changes in 12 years: Biomedical Technology

1MX





Source: Brookings, Wikimedia

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Disruption is coming to the water sector

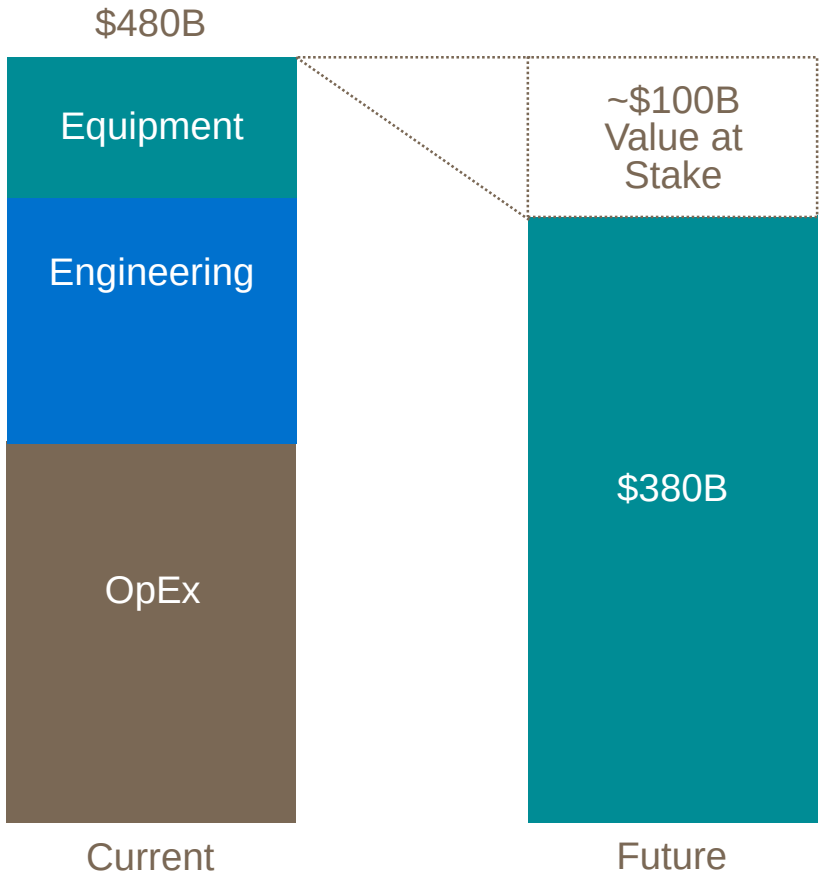
Trends

- **More data:**
  Greater temporal, spatial, parametric data density
- **More useful data:**
  Increasing interoperability of smart applications
- **Better analytics:**
  from situational awareness to decision support

Benefits

- Improved public health, environmental outcomes
- Less capital and operating intensity – affordability
- Better work experience

In the next 12 years, innovation will transform water



- $100B at stake as disruptive technology unlocks value
- Much of this surplus will be captured by end users and ratepayers
- Creates opportunity for needed reinvestment

Source: Global Water Intelligence, Team analysis

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Three big ideas for water

From the ER
to Primary Care

“UEA-MEP”

“If It Ain’t Broke…”

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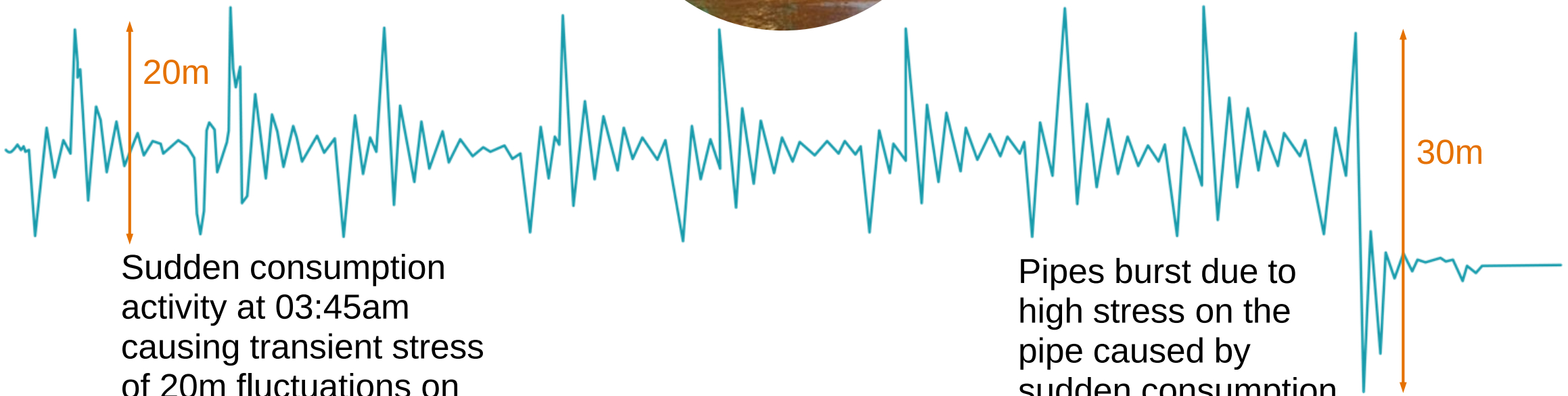
Detect events in real-time with greater sensor density



Sudden consumption activity at 03:45am causing transient stress of 20m fluctuations on the pipes

Pipes burst due to high stress on the pipe caused by sudden consumption

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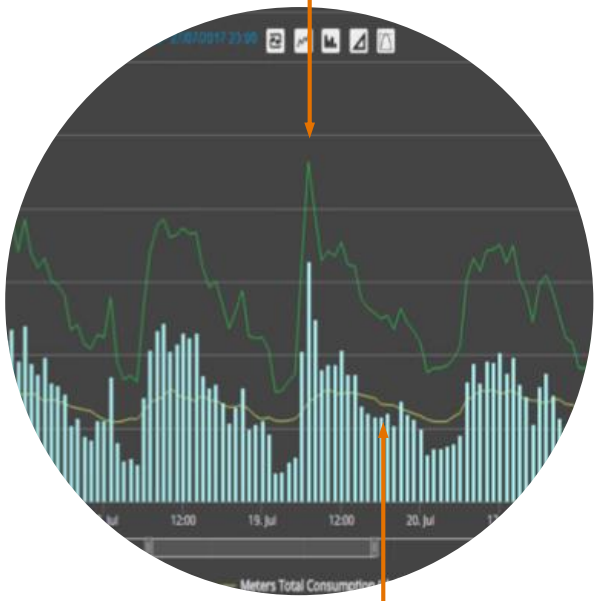
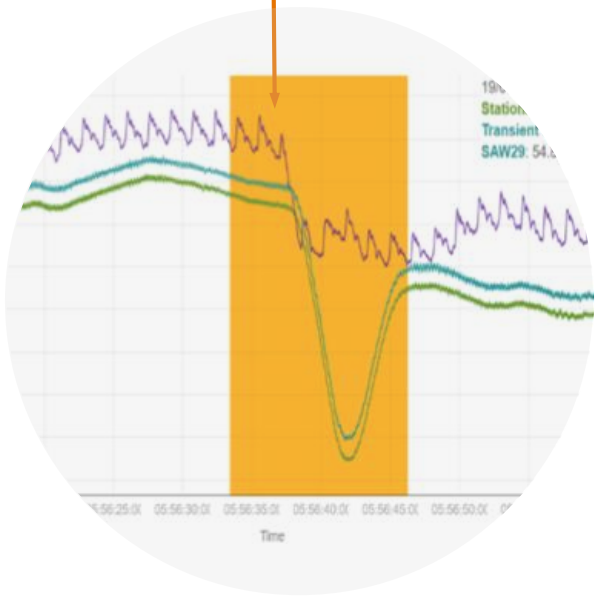
Drive to root cause with data integration and analytics

DMA inflow increase detected

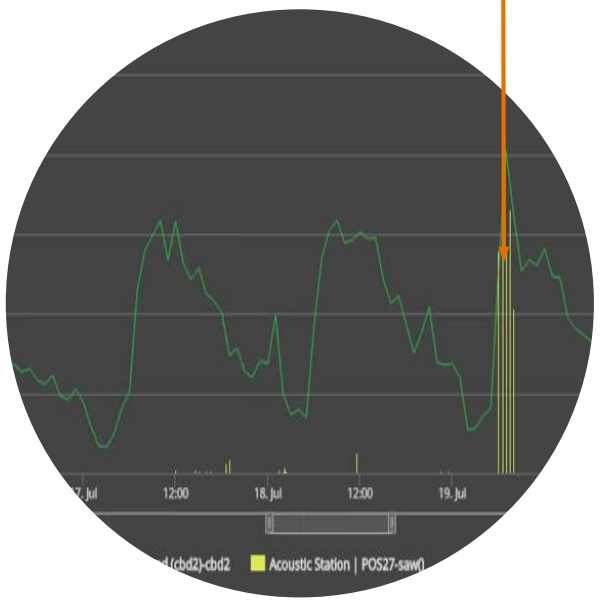


Stable customer consumption detected

Pressure transient detected



Increased acoustic noise detected



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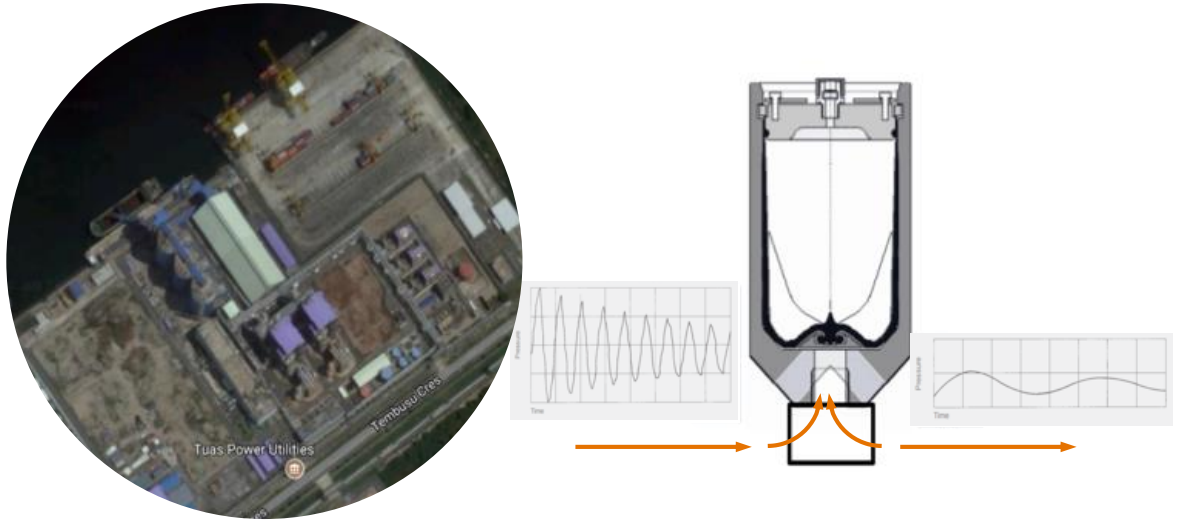
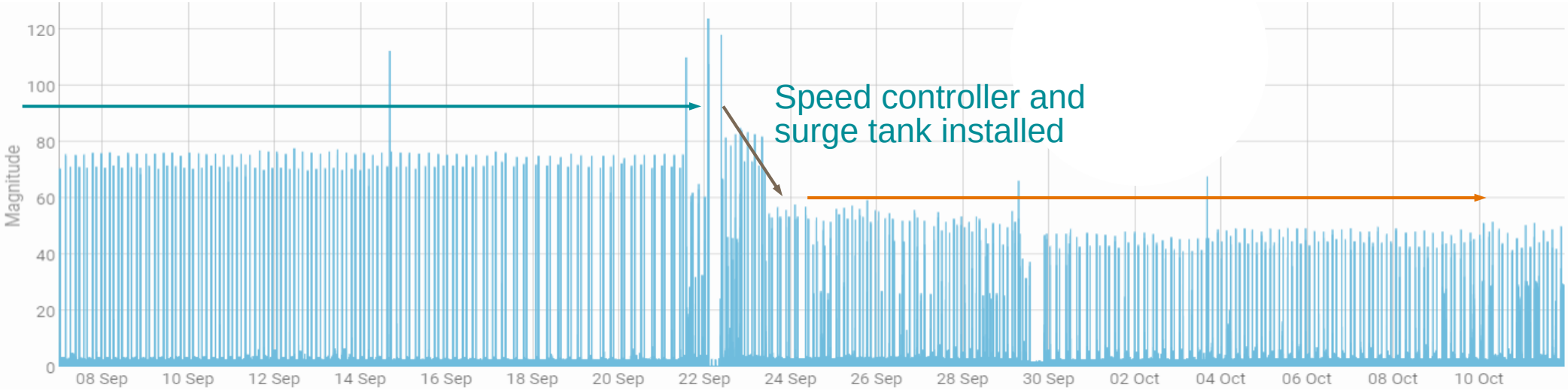
Preventing Breaks

Addressing sources of pressure surges removes fatigue and reduces failures

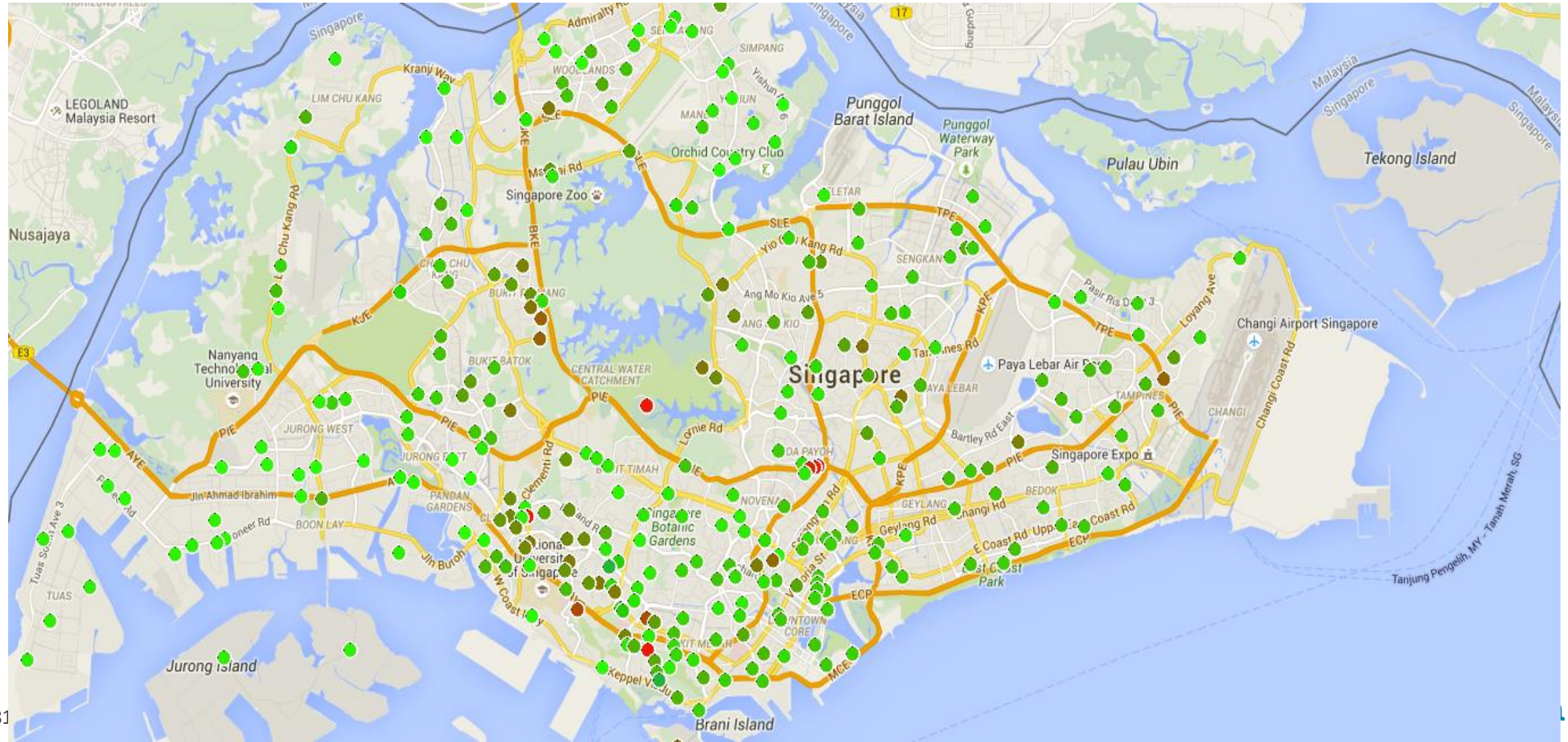


Absolute pressure change over time



Singapore’s Intelligent Water Network

Alarms intelligently ingested and visualized



Three big ideas for water

From the ER
to Preventative Care

“UEA-MEP”

“If It Ain’t Broke…”

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Adam
Data Scientist / Finance

TODAY

Adam 4:34 PM

hey Al, totally out of nowhere, but you are the only person I know in the water industry, and I have to imagine you are likely the best person to know in the water industry in North America. :) Can I ask you what you know about urban river remediation? I recently got a place on the north branch of the Chicago River, and I went kayaking there recently, and was amazed that under every bridge there are signs that say, "when it rains, I dump raw human waste, and you are required by law to tell the health department if you get a skin infection from it" etc. BLEW MY MIND. Do you know who or what I can support to even understand and advocate river cleaning stuff?

Like, this is kind of true:
https://www.nytimes.com/interactive/2018/08/02/us/chicago-river-waterfront.html

but also, there's human waste in the river.

Traditional solutions

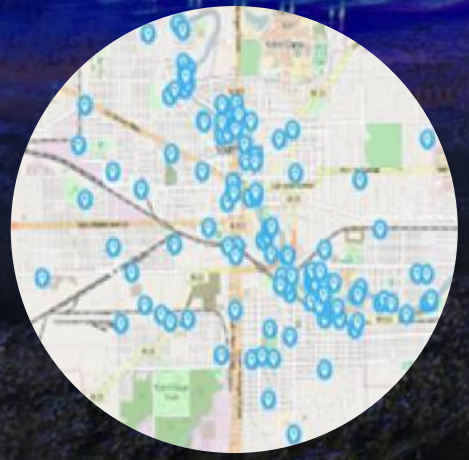
Cost for one city in:

Hawaii:	$5.0B
Missouri:	$4.5B
Ohio:	$3.0B
Missouri:	$2.5B
Indiana:	$2.0B
Florida:	$1.8B

Intelligent urban watershed

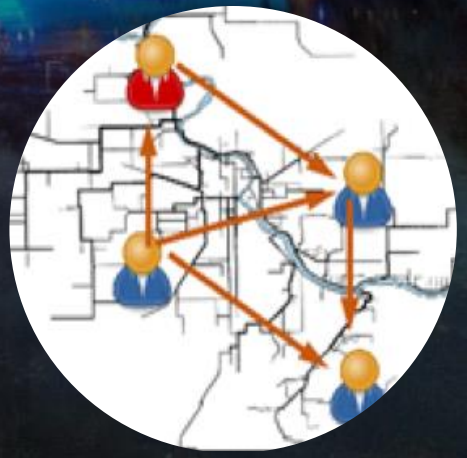
Control the urban watershed to improve
the environment while saving taxpayers money

Internet of Things/
Edge Computing

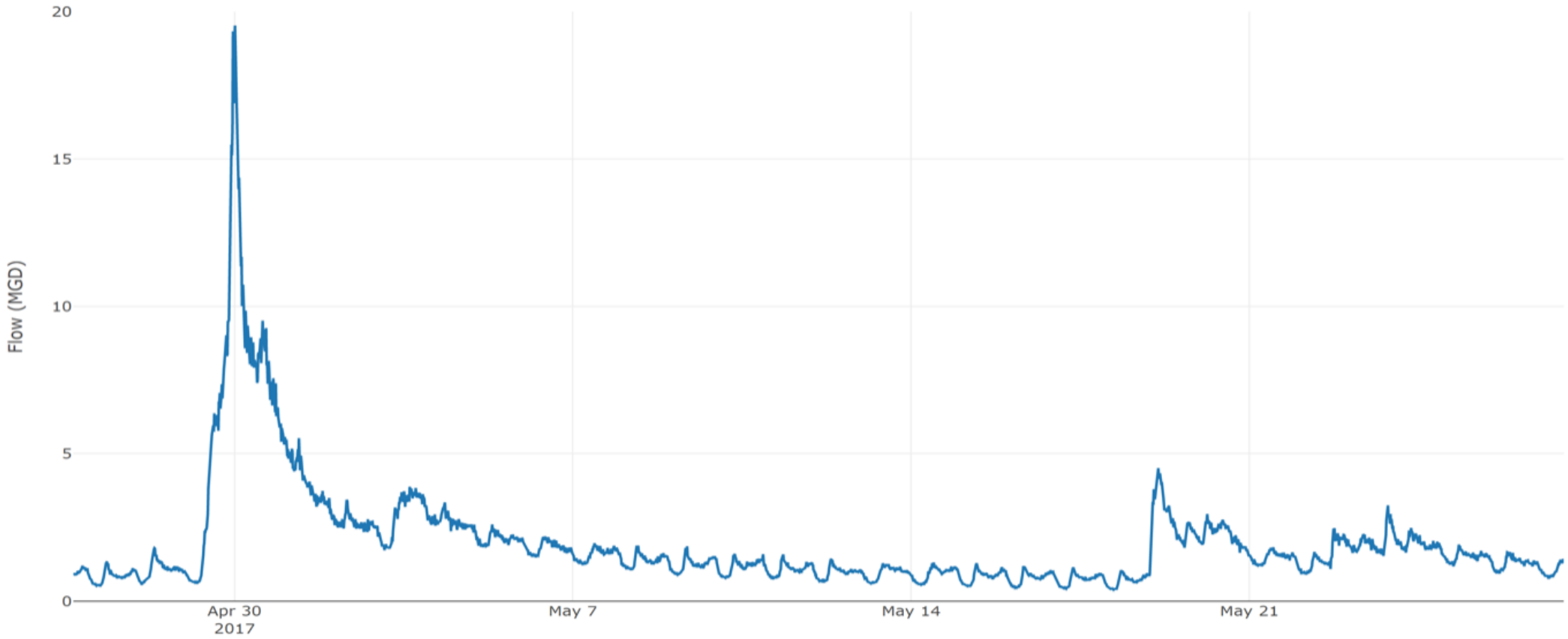


Machine Learning

Dynamic Control



Measured Flow: S150-233



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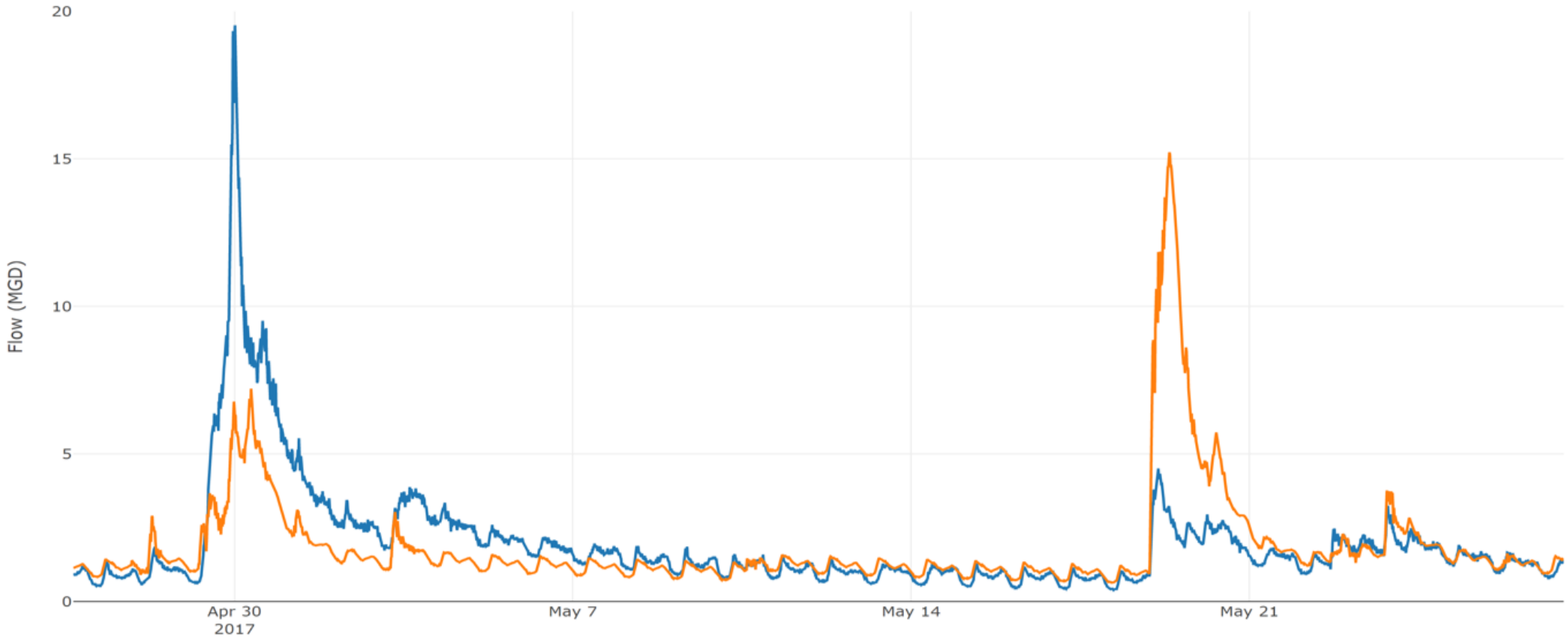
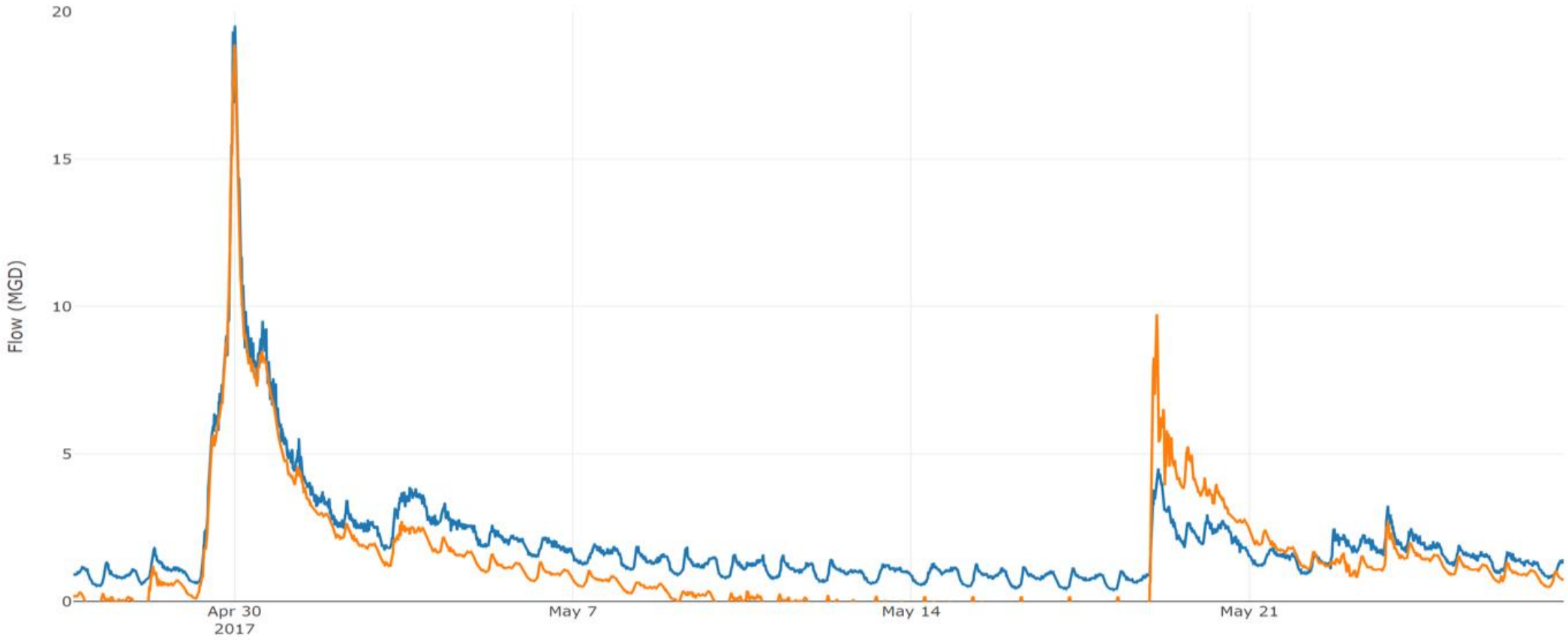
5 weeks



10 weeks



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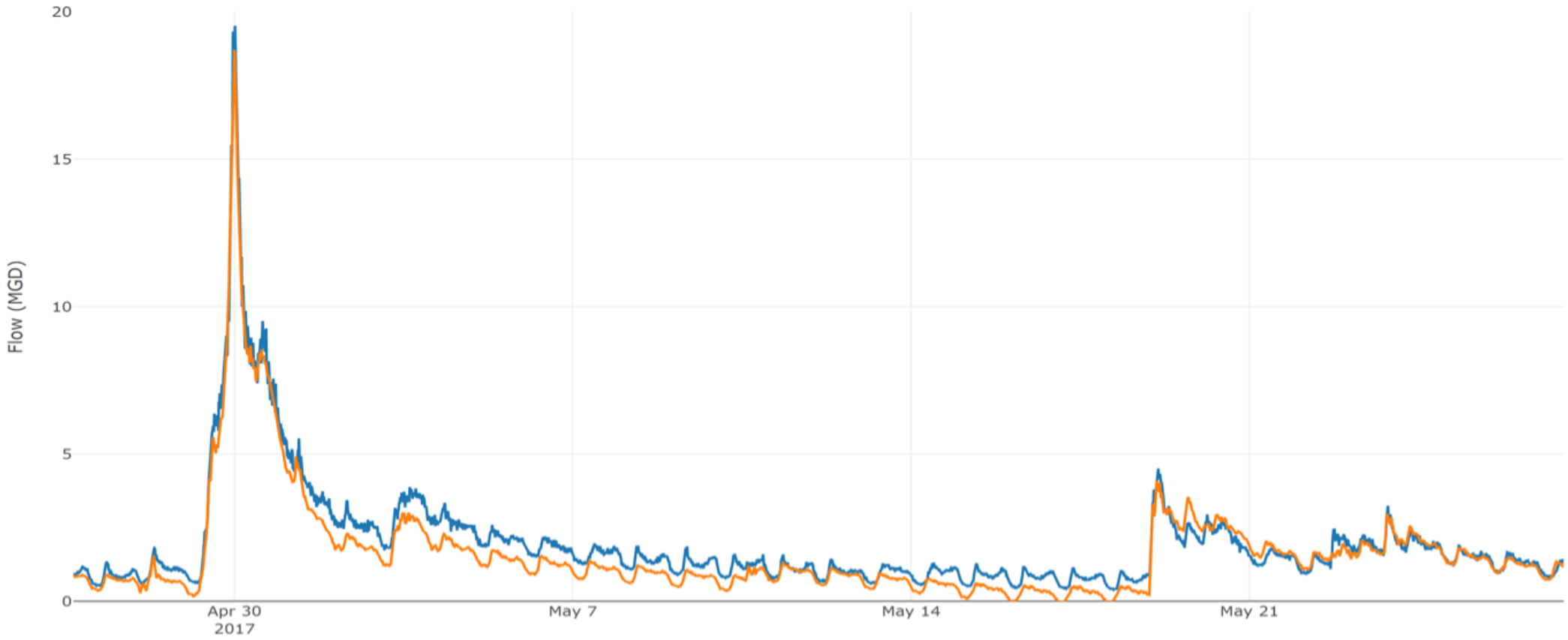
15 weeks



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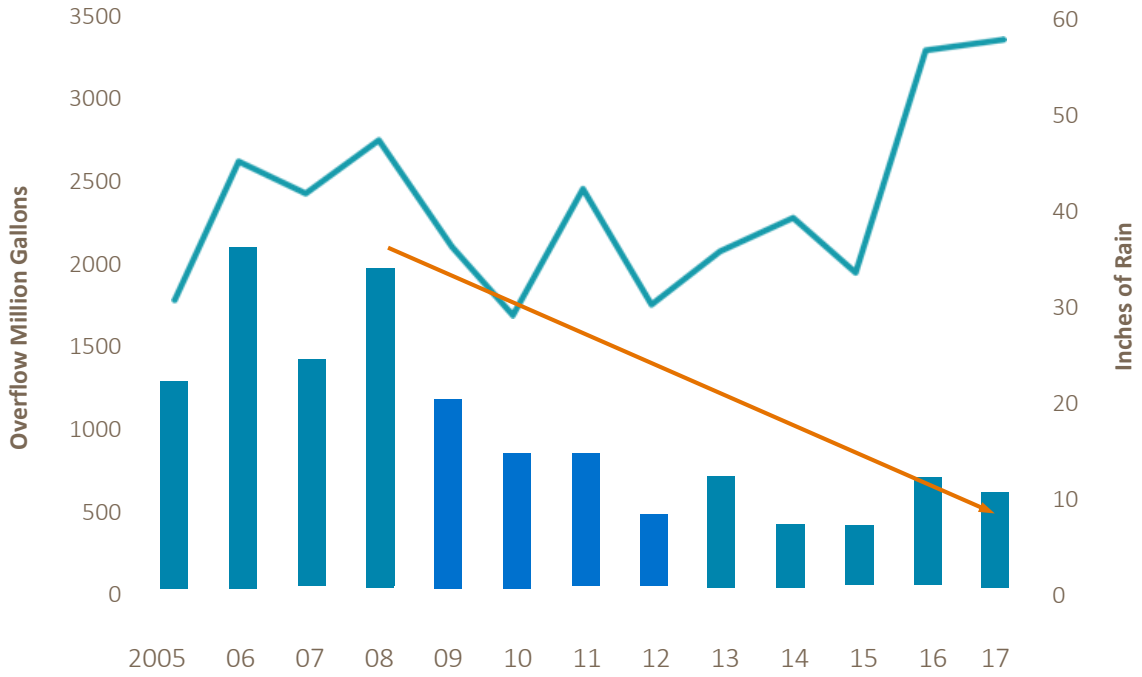
Outcomes of active control

More rain, fewer overflows – with less expenditure



FAST COMPANY

08.05.13

How South Bend, Indiana Saved $100 Million By Tracking Its Sewers

Back when the Big Three was the Big Four, South Bend, Indiana, was a thriving industrial city. Until it wasn't. Not wanting to go the way of Detroit, citizens turned to Peter Buttigieg, a 31-year-old McKinseyian, to shake things up. Is there really any surprise that he's rocking it?

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Three big ideas for water

From the ER
to Preventative Care

“UEA-MEP”

“If It Ain’t Broke…”

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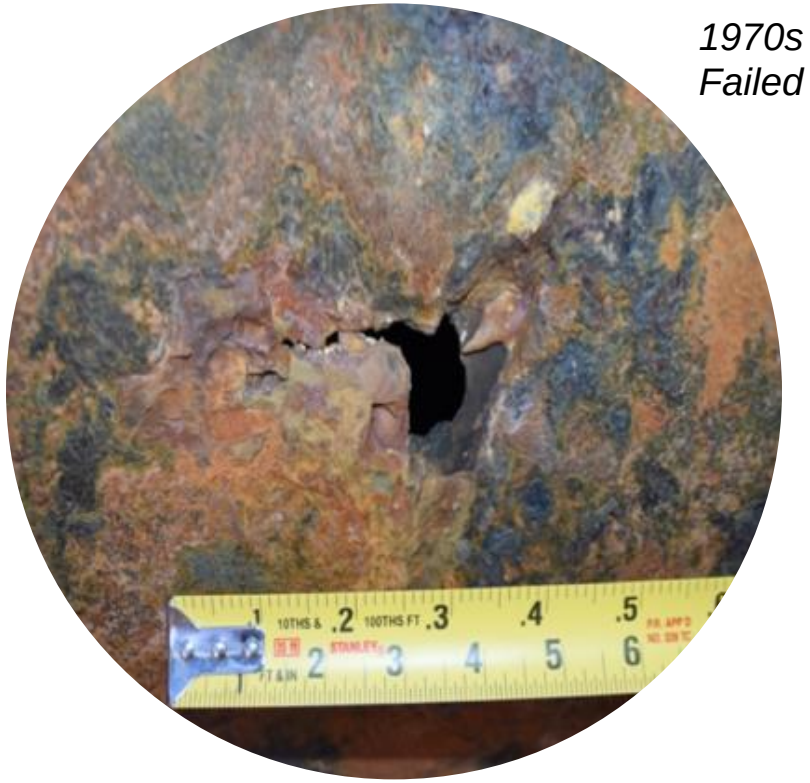
A Tale of Two Pipes

1920s Cast Iron Pipe, Great Condition

1970s Ductile Iron Pipe, Failed



- Age Rarely Correlates With Condition
- 70% To 90% Of Replaced Pipelines Have Remaining Life
- Better Data, Advanced Analytics and Risk Management Strategies Can Save Billions

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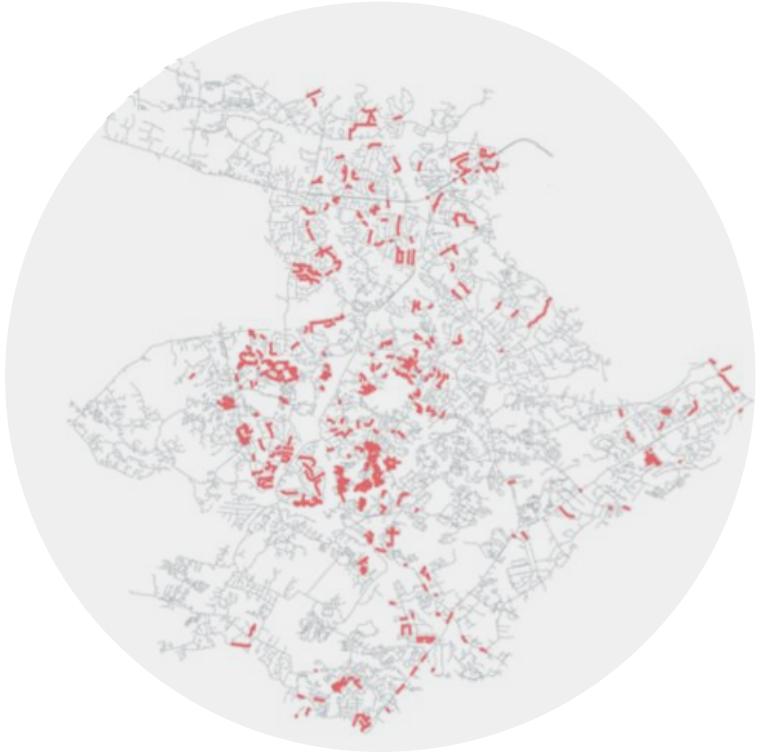
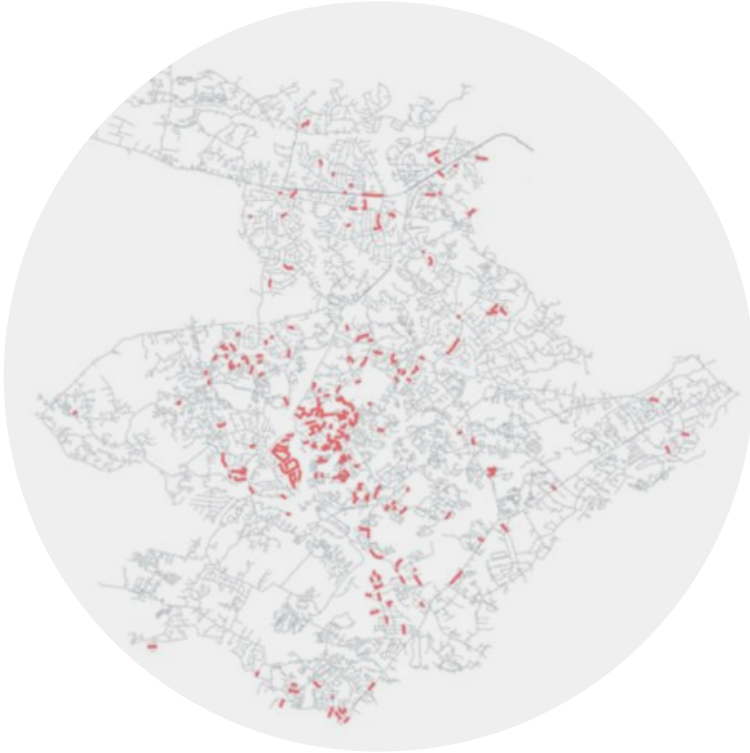
Artificial Intelligence Improves Standard of Care

Traditional risk management



AI-based risk management



Dramatic risk, cost and time improvement

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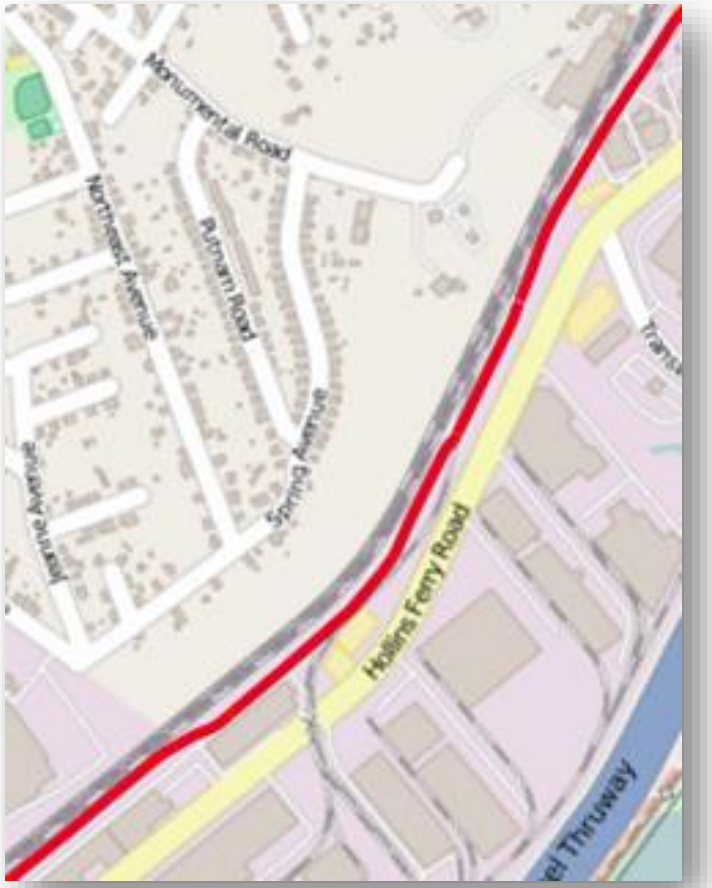
AI, Surgical Application & Risk



Pre Inspection Plan

$6M

Post Inspection Plan

$1M

Do taxpayers want us to replace good pipes?

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Transforming water with technology

- The call to action
- Transformation opportunity
- **What leaders can do**

Image credit: WaterCanada

Set and broadcast an ambitious but achievable vision

Could your governor leave a legacy of…

- Achieving water security?
- Ending sewer overflows and algal blooms?
- Ensuring water affordability?

Set performance metrics and incentives

- Benchmark performance
- Encourage innovative targets
- Set productivity goals

Be a water innovation champion!

- Shine a spotlight into the sewer
- Remove bottlenecks
- Fight for common sense

Thank you!


NGA
NATIONAL GOVERNORS ASSOCIATION

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Building Resiliency into Agriculture Water with Advanced Technology & Policy Innovation

Tracy Streeter, Director, Kansas Water Office

Robyn Grimm, Senior Manager, Water Information Systems, Environmental Defense Fund

Moderator: Joaquin Esquivel, Board Member, California State Water Resources Control Board

Groundwater from aquifers provides drinking water for

HALF THE U.S. POPULATION

NEARLY ALL THE RURAL POPULATION

and provides over **50 billion gallons** per day for
agricultural needs

Cumulative Groundwater Depletion 1900-2008

https://water.usgs.gov/edu/gwdepletion.html

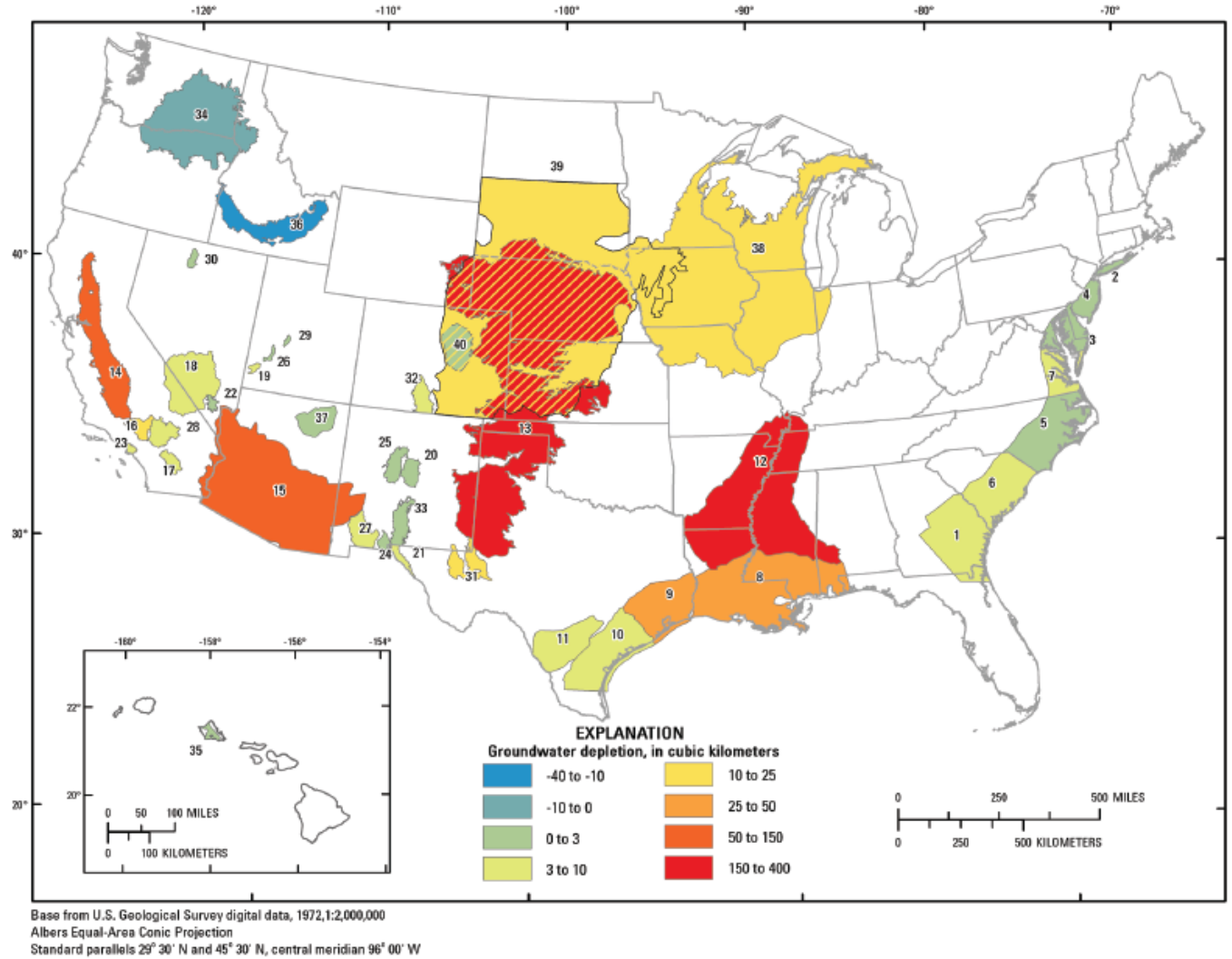
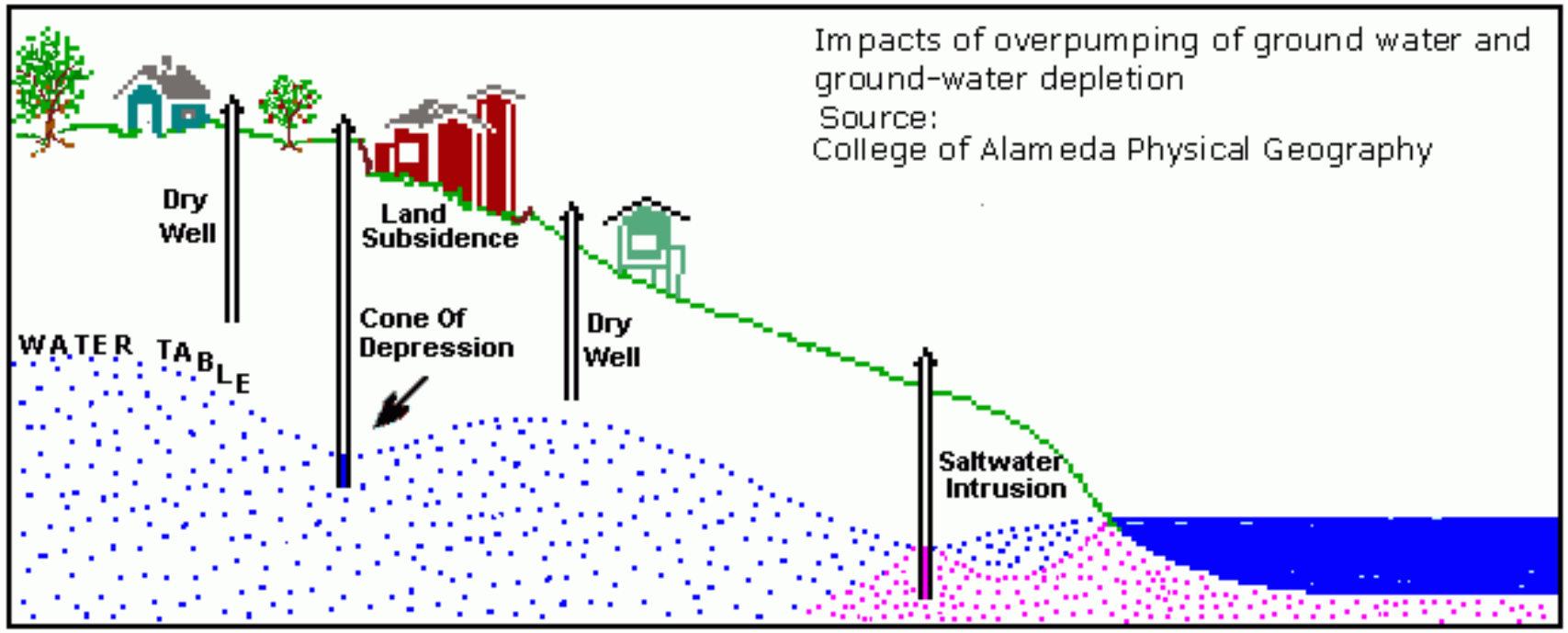


Figure 2. Map of the United States (excluding Alaska) showing cumulative groundwater depletion, 1900 through 2008, in 40 assessed aquifer systems or subareas. Index numbers are defined in table 1. Colors are hatched in the Dakota aquifer (area 39) where the aquifer overlaps with other aquifers having different values of depletion.

Impacts of ground water depletion include dry wells, land subsidence, saltwater intrusion, reduction of water in streams and lakes, deterioration of water quality, increased energy and costs for pumping.

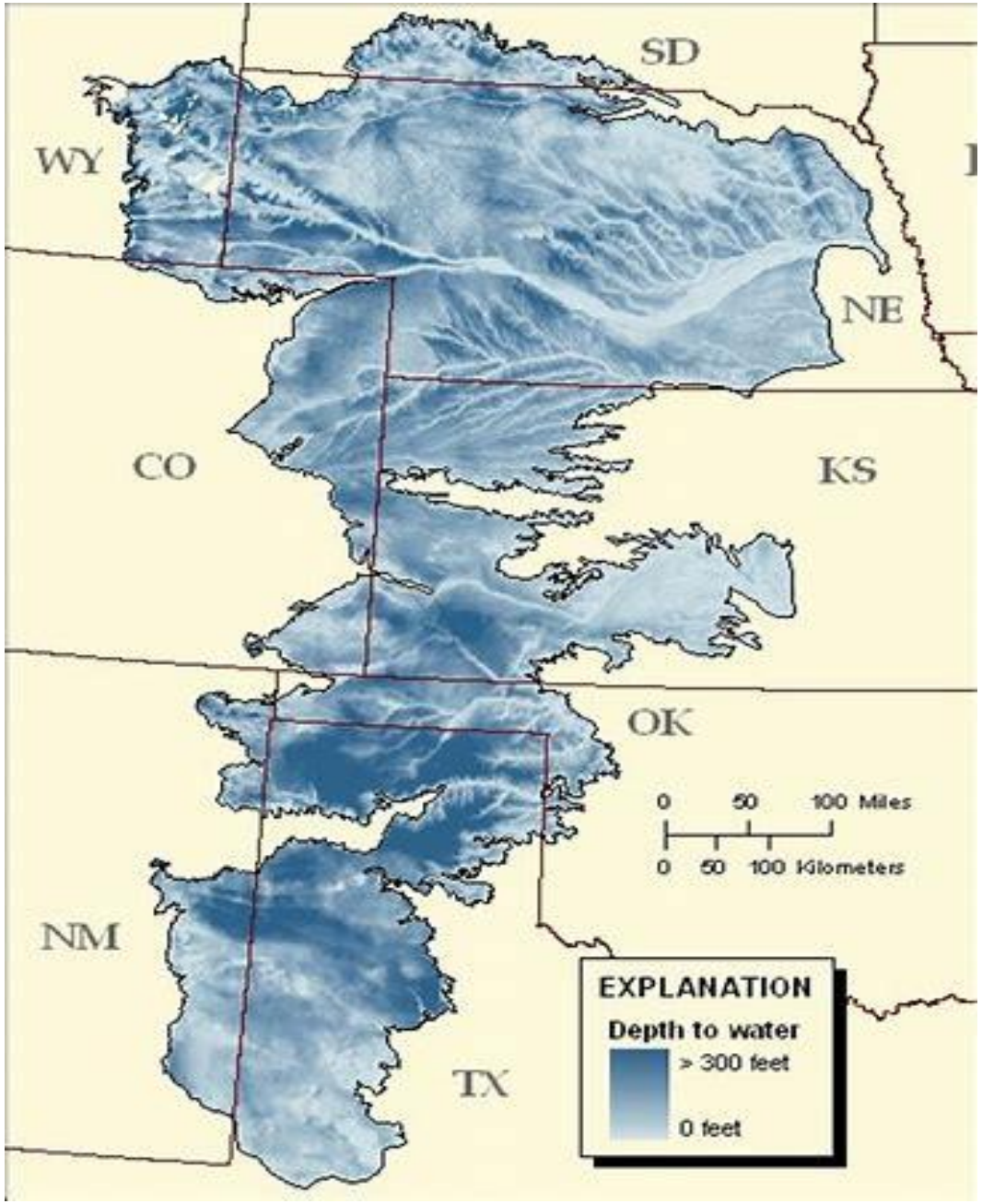


KANSAS APPROACH TO GROUNDWATER CONSERVATION

National Governor's Association

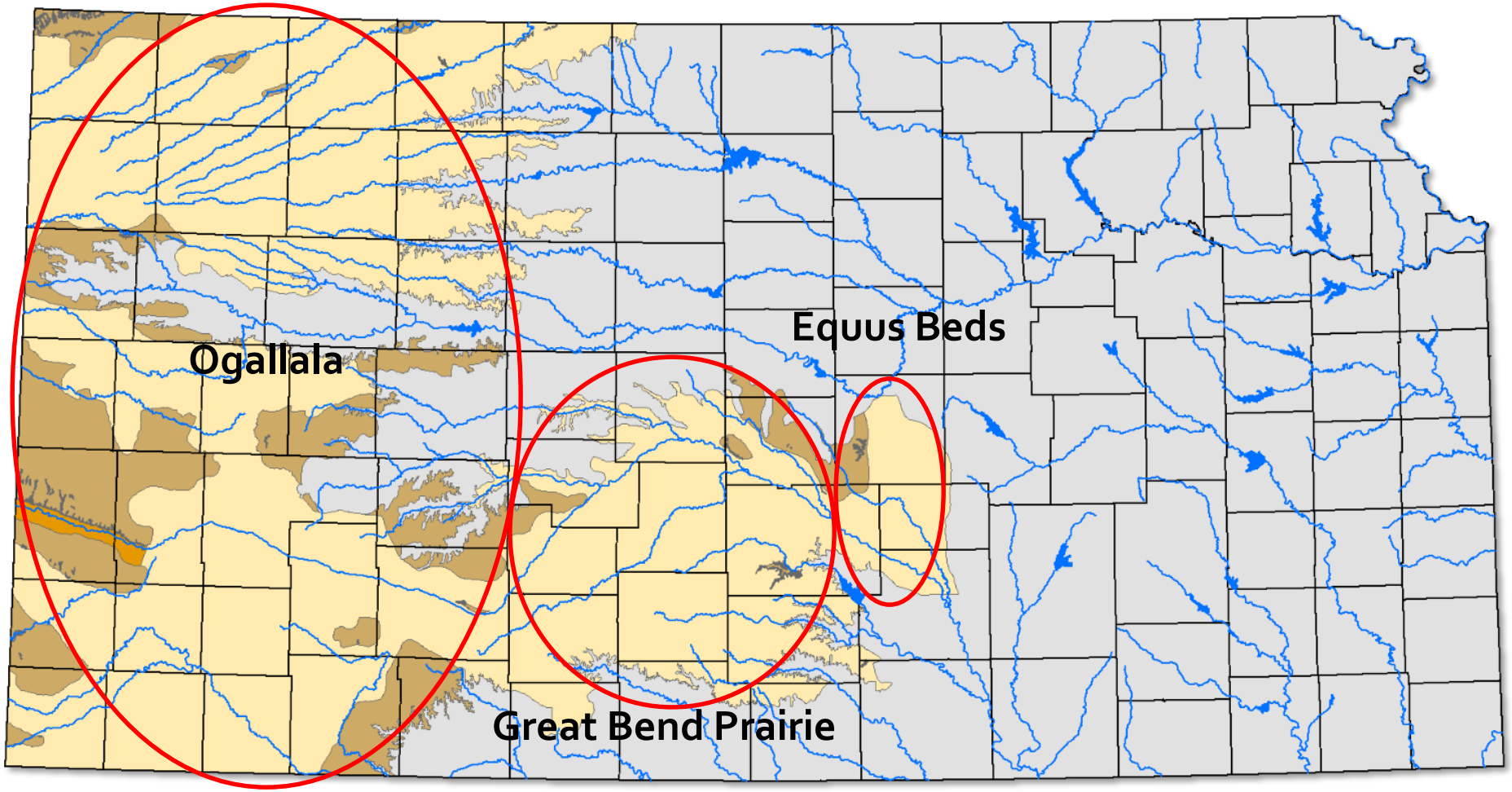
Water Policy Institute

September 11, 2018

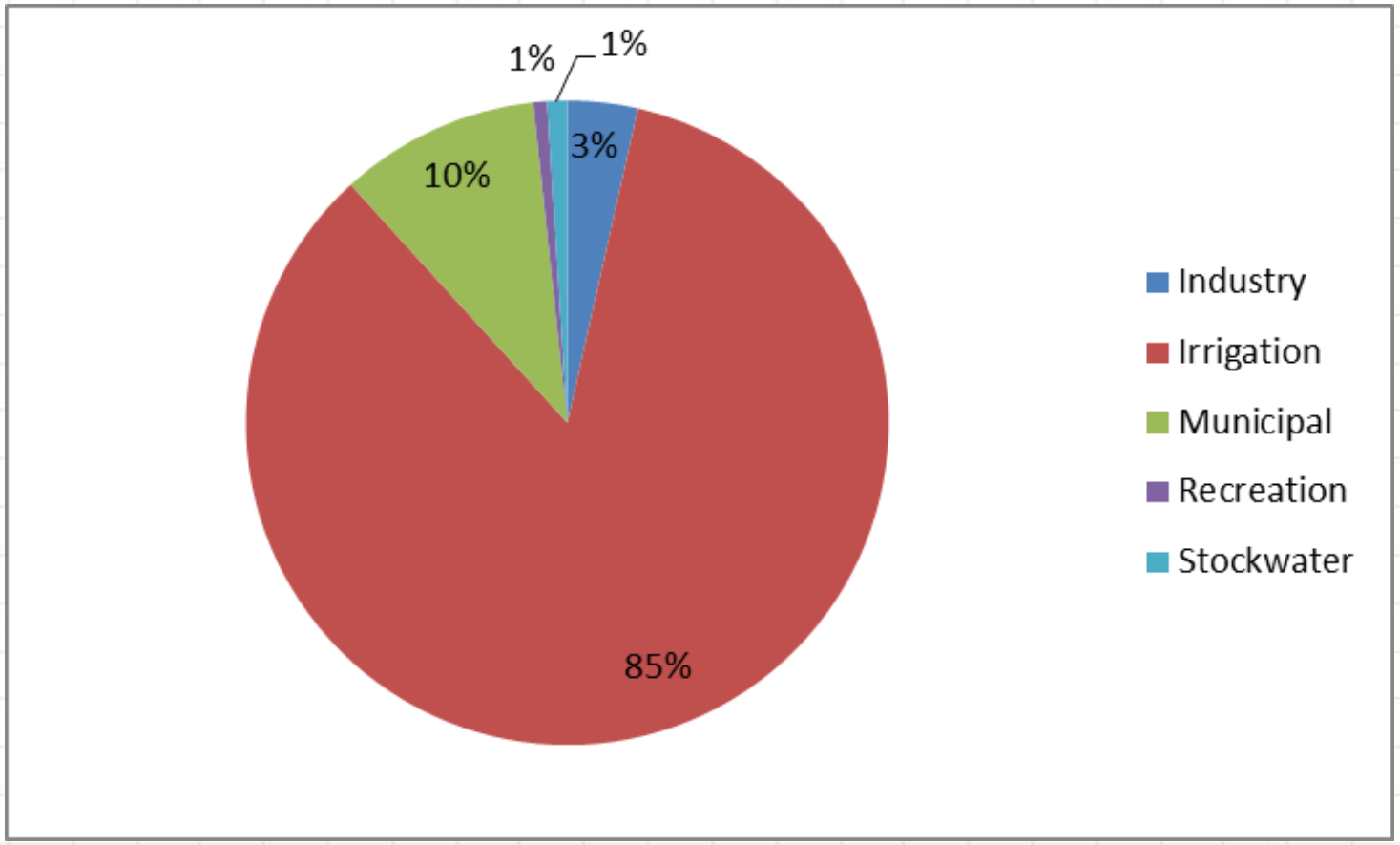


The Ogallala-High Plains Aquifer

The Kansas High Plains Aquifer

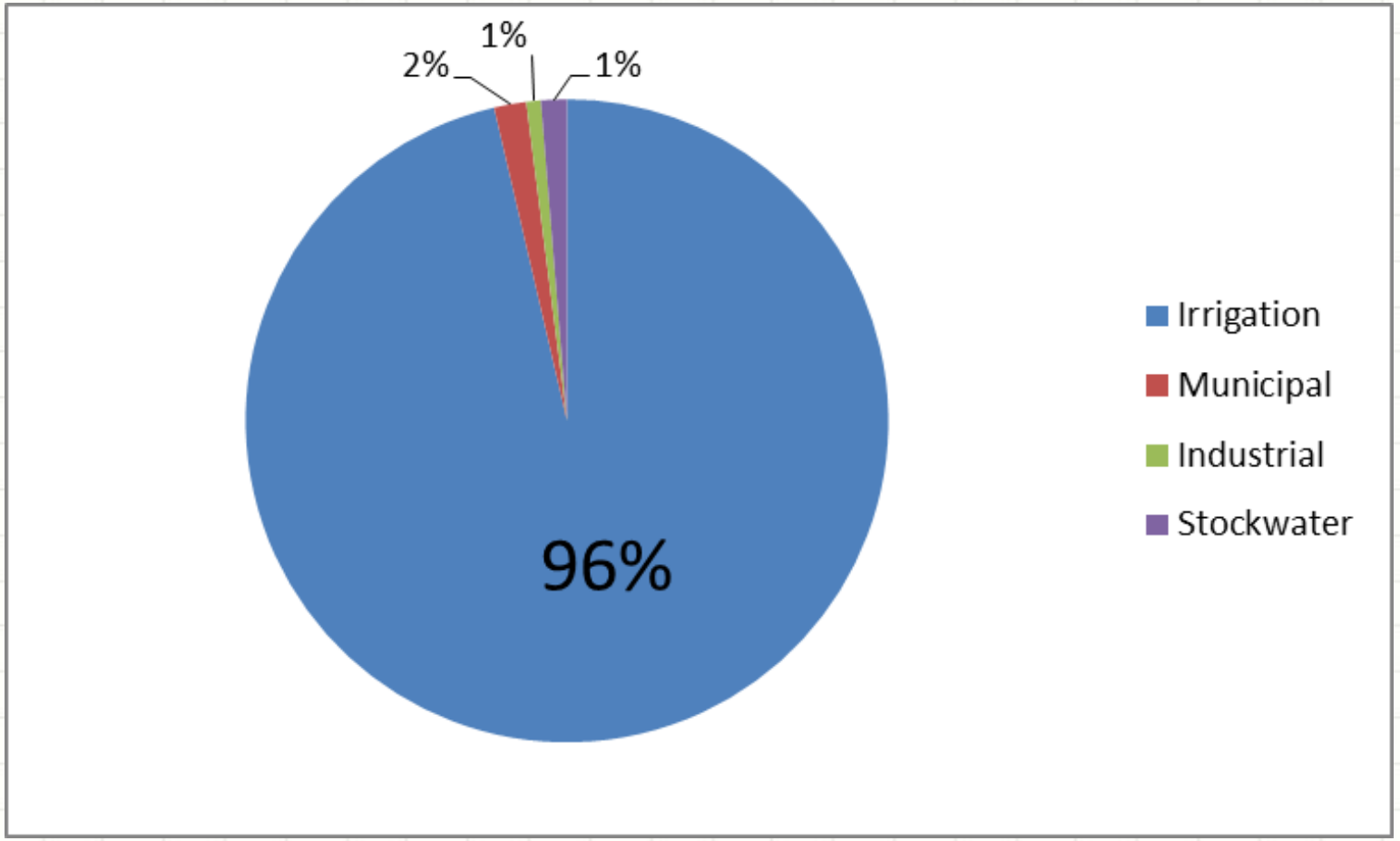


2015 Kansas Water Use – 4.3 million acre-feet



1 acre-foot = 325,851 gallons

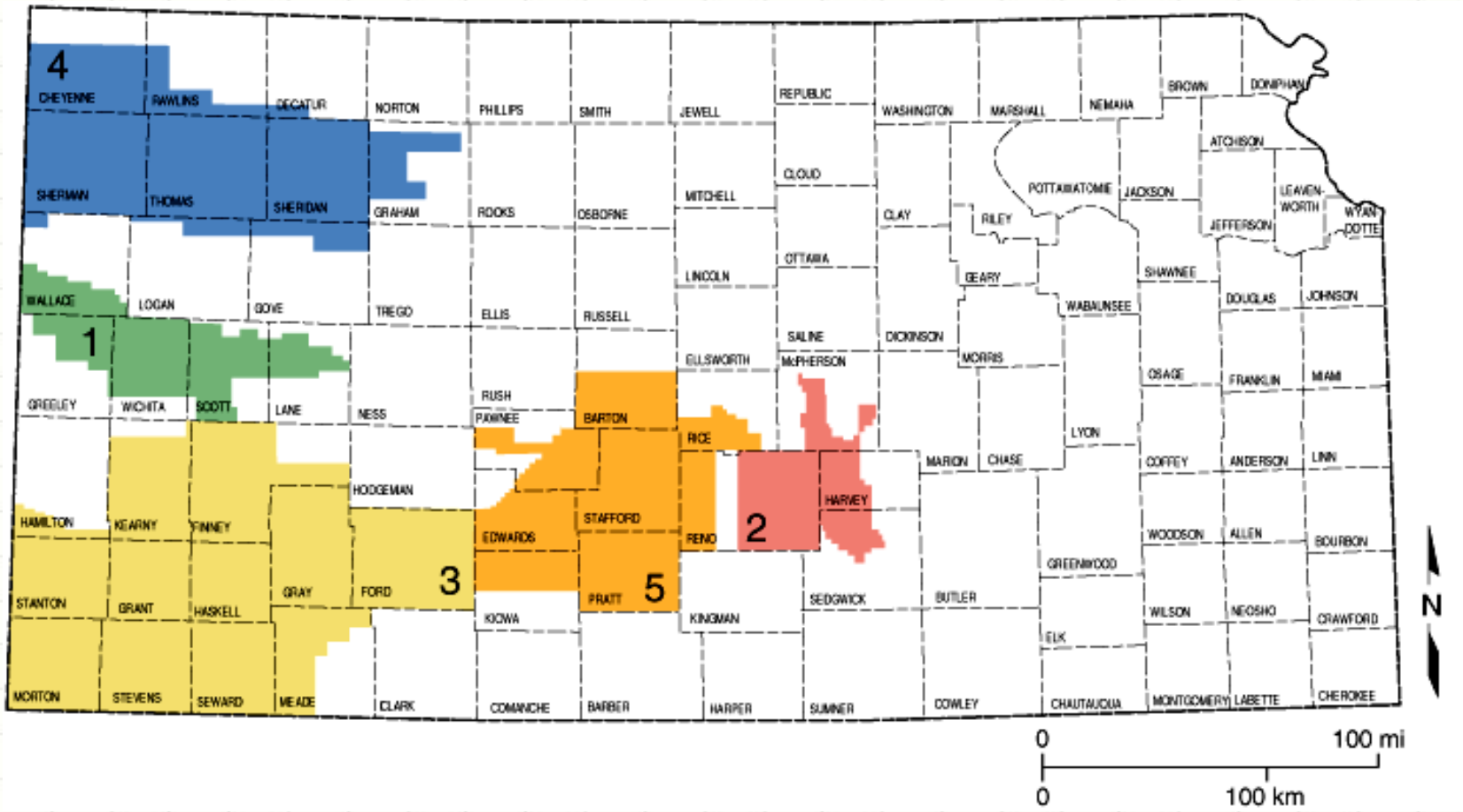
2015 Ogallala Water Use – 2.85 million acre-feet



Kansas Water Laws

- 1945, Kansas Water Appropriation Act created (Prior Appropriation Doctrine)
- 1972, Groundwater Management District (GMD) Act. – Authorized local unit of government to lead in local water conservation efforts
- 1978, GMD Act amended authorizing Intensive Groundwater Use Control Areas (IGUCA)
- 2012: Local Enhanced Management Areas (LEMA) authorized for GMDs
- 2012: Eliminating abandonment of groundwater rights in closed areas. AKA repealing “use it or lose it”
- 2015: Water Conservation Areas (WCA’s) authorized
- 2015: Requirement to give due consideration of past voluntary conservation in all conservation programs

GMDs in Kansas



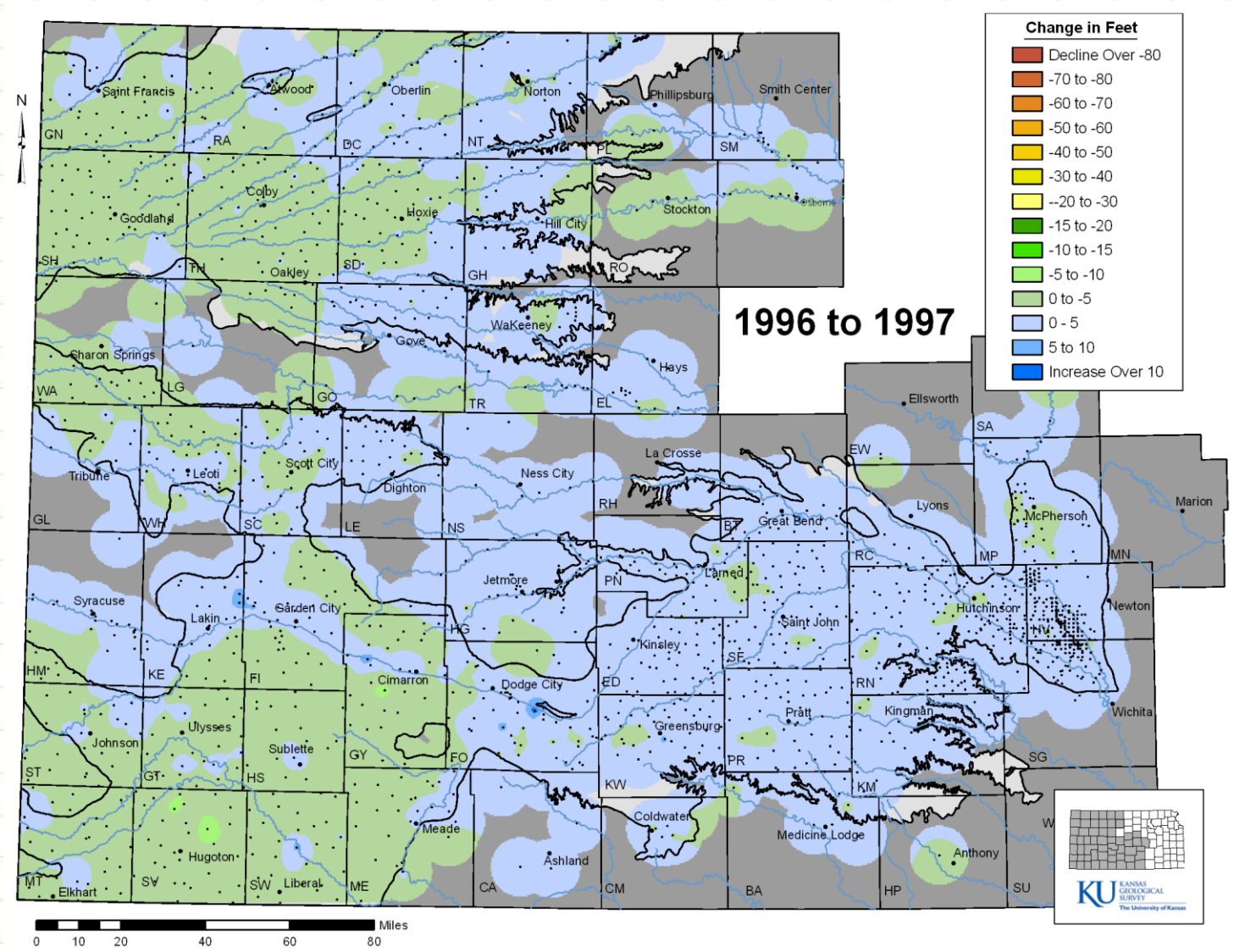
"Water and the Kansas economy are directly linked. Water is a finite resource and without further planning and action we will no longer be able to meet our state's current needs, let alone growth."

- Governor Sam Brownback

If We Take No Action in the Next 50 Years…

- The Ogallala will be 70% depleted
- Another 40% of the area irrigated by the Ogallala won’t support a 400 gal per minute well

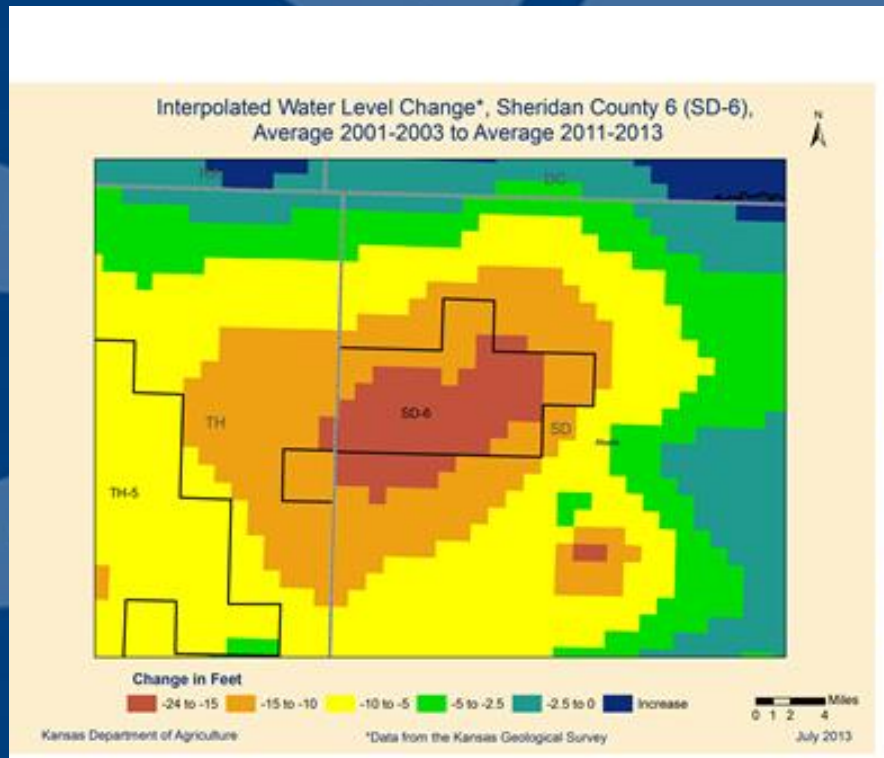
Aquifer declines 1996 - 2017

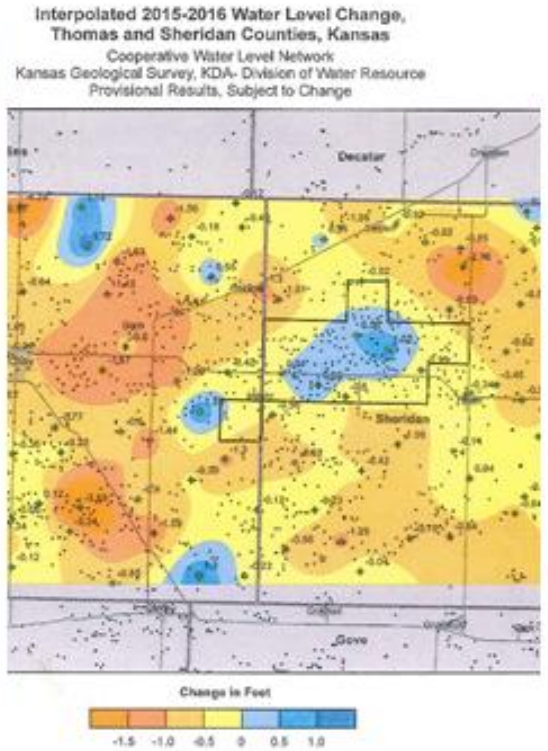


Governor's 50 Year Water Plan aka…Kansas Water Vision

Local Enhanced Management Areas (LEMA)

- 1st LEMA established in Sheridan County
  - 100 sq mi, 5 year, 55” allocation per water right, 20% reduction
  - 5th year complete, renewed for 5 more years
  - Economic evaluation showed no significant impact

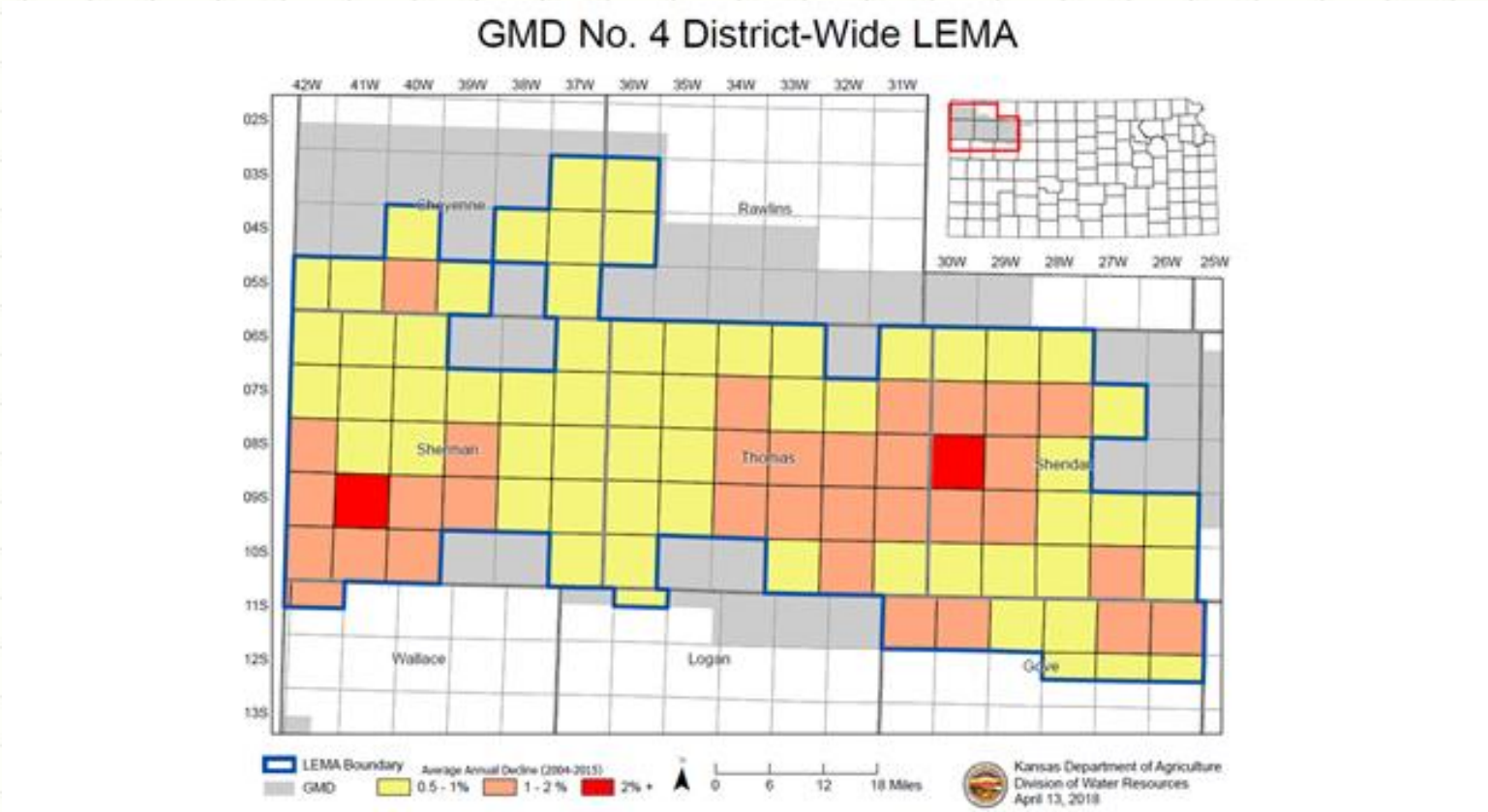




Kansas Water Office

LEMA Expansion in NW Kansas

- Approved GMD #4 District-Wide



GMD 4 District-wide LEMA legal challenges

- In Gove County District Court (Friesen vs. Barfield), petition for judicial review filed, challenges the process to develop the LEMA order and the validity of K.S.A. 82a-1041 (the LEMA statutory provisions), particularly allowing allocations that do not consider priority.
- In Thomas County, a petition for judicial review filed seeking review of the LEMA order, esp. as related to GMD's authority to make final decisions on allocation appeals.

WCA Status

- 23 approved or pending
  - Nearly 25,000 irrigated acres enrolled
- Level of conservation ranges from 10-29% of average water use in approved plans
- Multi-year allocations
- Flexibility to move water between enrolled water rights
- Totally voluntary

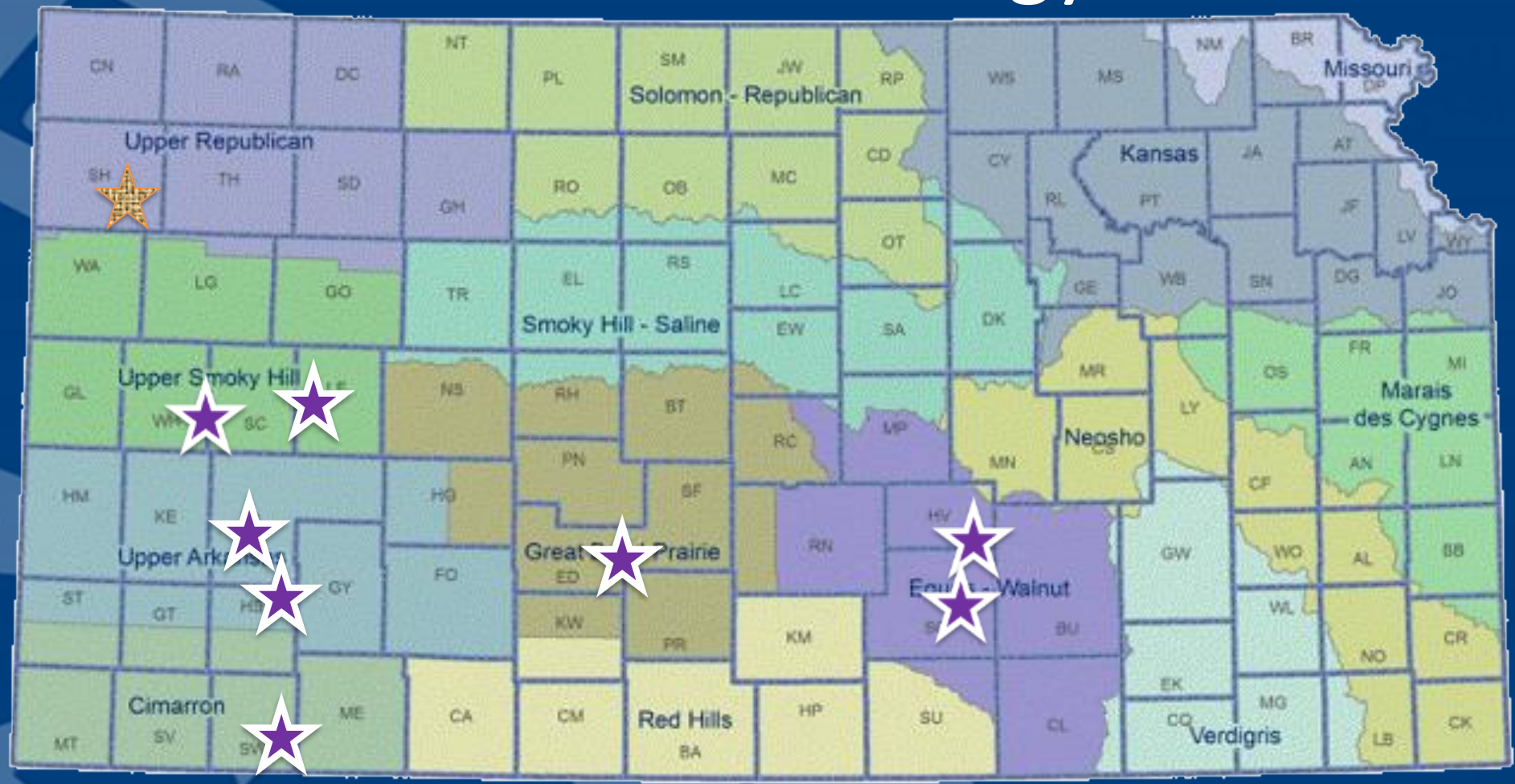
Kansas Water Office

Water Technology Farms

- 12 farms participating
- KSU, Northwest Tech and private consultants provide water management advice
- Public/private partnerships securing the $

Showcase on a field scale, the latest technologies in irrigation infrastructure, irrigation water management, soil moisture management, conservation tillage, automation telemetry and other agronomic practices aimed at reducing water use.

2018 Water Technology Farms



Kansas Water Office


KANSAS
CORN
COMMISSION


servi
tech
Expanded Premium
Services, LLC


CropMetrics
Yield Optimization Technology


NETAFIM
PMDI PRECISION MOBILE
DRIP IRRIGATION TECHNOLOGY


AD ASTRA PER ASPERA
Kansas
Water Office


Seaman
CROP CONSULTING


Conestoga
energy partners, LLC


KANSAS
GRAIN
SORGHUM
Growers Working Together


KU
KANSAS
GEOLOGICAL
SURVEY
The University of Kansas


HELENA


AD ASTRA PER ASPERA
Kansas
Department of Agriculture


syngenta


AquaSpy


KANSAS FARM BUREAU
The Voice of Agriculture


SORGHUM
CHECKOFF


KANSAS STATE
UNIVERSITY
Kansas
Mesonet


VALLEY


gallala Aquifer

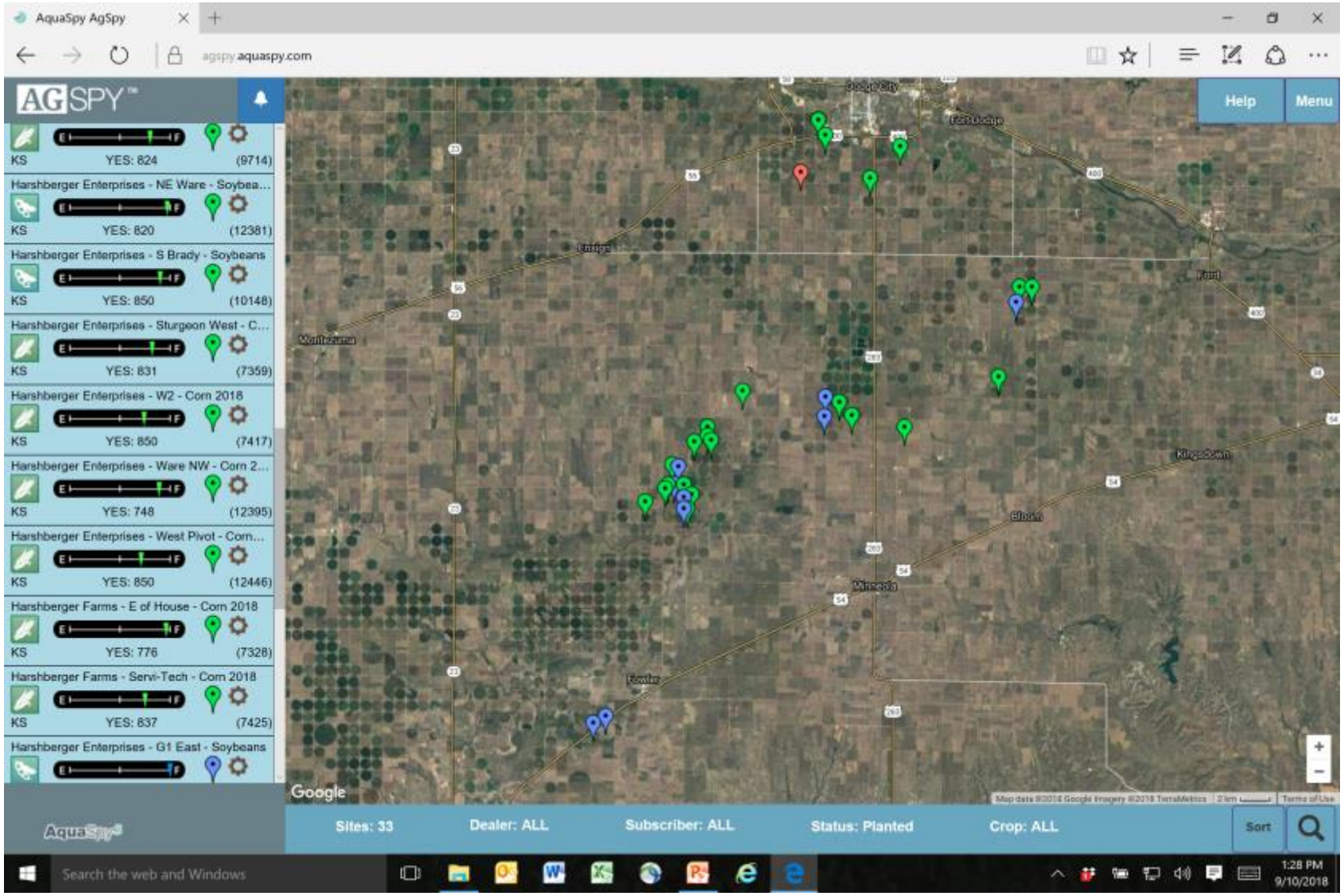

TEETER
IRRIGATION, INC.
MAKING EVERY DROP OF WATER COUNT

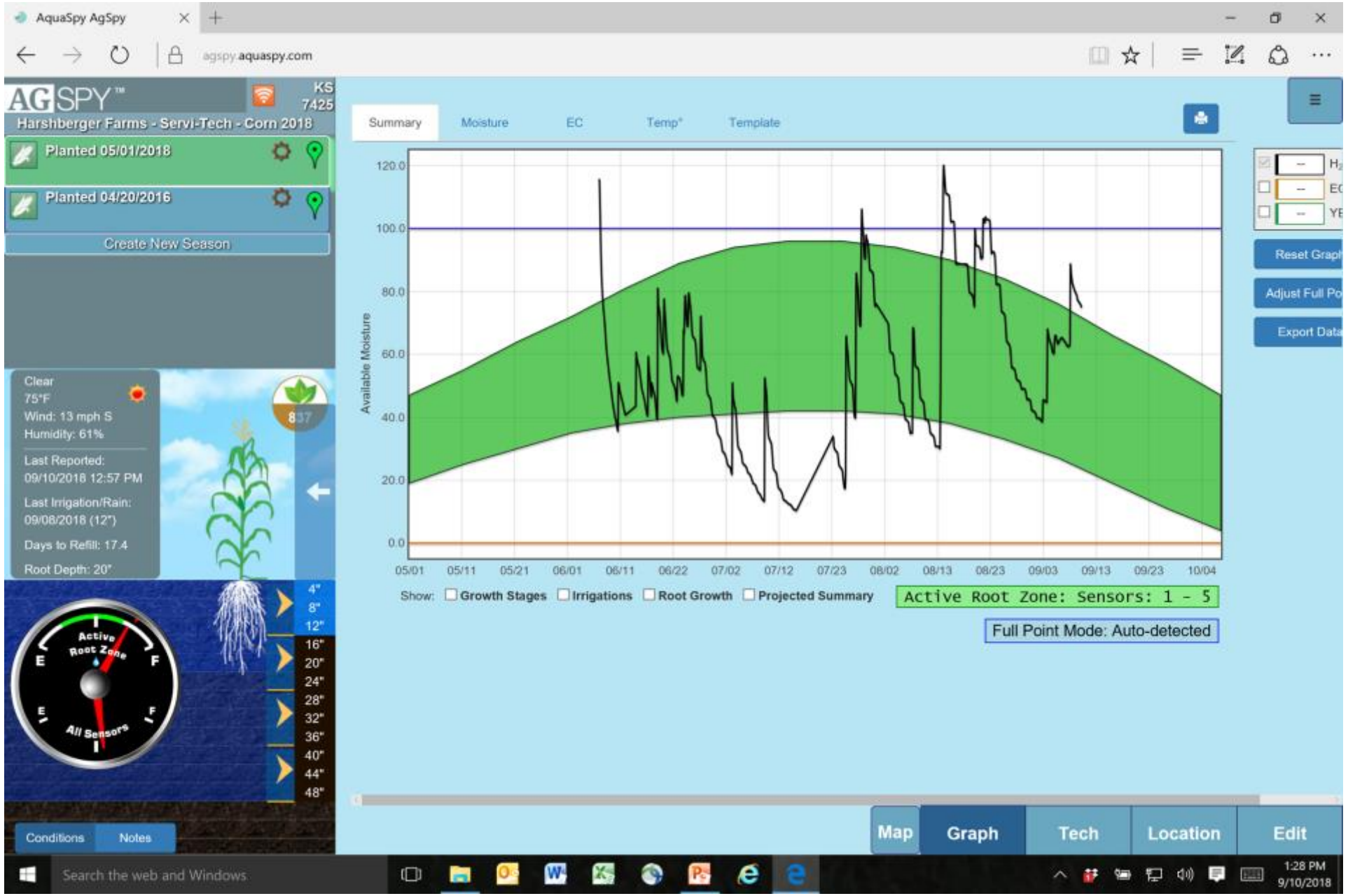

DRAGON-LINE


HORTAU
SIMPLIFIED IRRIGATION

SW KS GMD #3

Measuring soil moisture is key




AquaSpy AgSpy
agspy.aquaspy.com
AGSPY™
KS
7425
Harshberger Farms - Servi-Tech - Corn 2018
Planted 05/01/2018
Planted 04/20/2016
Create New Season
Clear
75°F
Wind: 13 mph S
Humidity: 61%
Last Reported:
09/10/2018 12:57 PM
Last Irrigation/Rain:
09/08/2018 (12")
Days to Refill: 17.4
Root Depth: 20"
837
Active Root Zone
All Sensors
E
F
4"
8"
12"
16"
20"
24"
28"
32"
36"
40"
44"
48"
Conditions
Notes
Summary
Moisture
EC
Temp°
Template
Available Moisture
120.0
100.0
80.0
60.0
40.0
20.0
0.0
05/01
05/11
05/21
06/01
06/11
06/22
07/02
07/12
07/23
08/02
08/13
08/23
09/03
09/13
09/23
10/04
Show:
Growth Stages
Irrigations
Root Growth
Projected Summary
Active Root Zone: Sensors: 1 - 5
Full Point Mode: Auto-detected
Reset Graph
Adjust Full Po
Export Data
Map
Graph
Tech
Location
Edit
Search the web and Windows
1:28 PM
9/10/2018

Public outreach and other activities

Kansas Water Office
AD ASTRA PER ASPERA

WTF/WCA Results

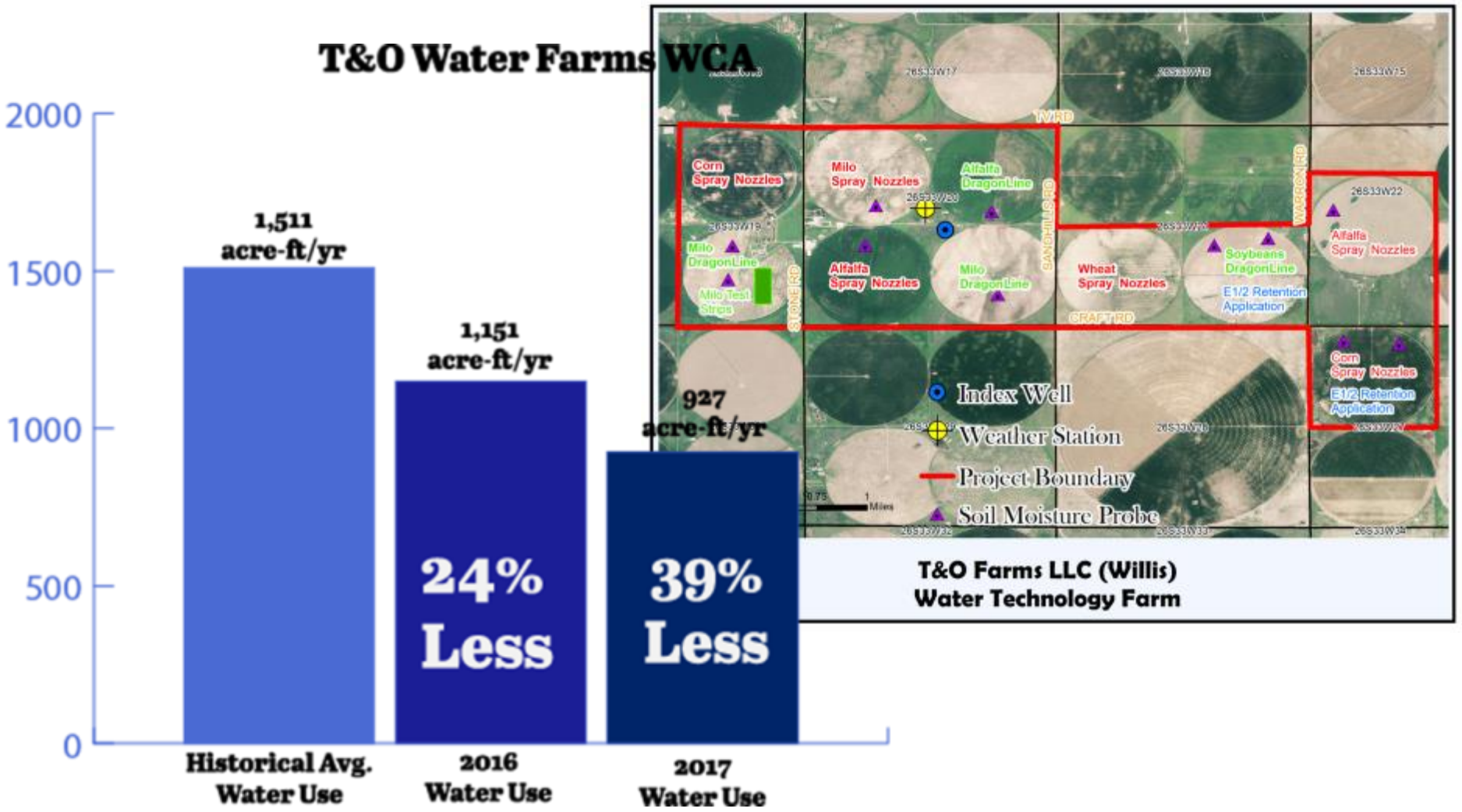
- Roth - Garden City
  - Yield – 241 bu. on 5”
  - Neighbor’s yields
    - 233 bu. on 14”
    - 222 bu. on 13.5”
  - Soil moisture probes made the difference

Franklin Farms-Goodland

- Added probes in ’17
- 9.8” applied
- Yield 208 bu.
- Saved $74 per acre on pumping costs

Kansas Water Office

MEASURING SUCCESS



Building Water Resource Workforce

- NW Tech & Local Irrigation Companies partnering with neighboring landowners, GMD 4 and KWO to develop water technology farms within the Precision Ag Dept at NT
- Students working on campus & in the field to develop irrigation water management skills
- Irrigation Technology (soil probes, Variable Rate Irrigation) and Scheduling to demonstrate water savings and profitability
- Six farms participating this year

NT
PRECISION AGRICULTURE

AD ASTRA PER ASPERA
Kansas
Water Office

OpenET

Filling the Biggest Data Gap in Water Management

Robyn Grimm, PhD, EDF

September 11, 2018

NGA 2018 Annual Water Policy Institute

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

NASA

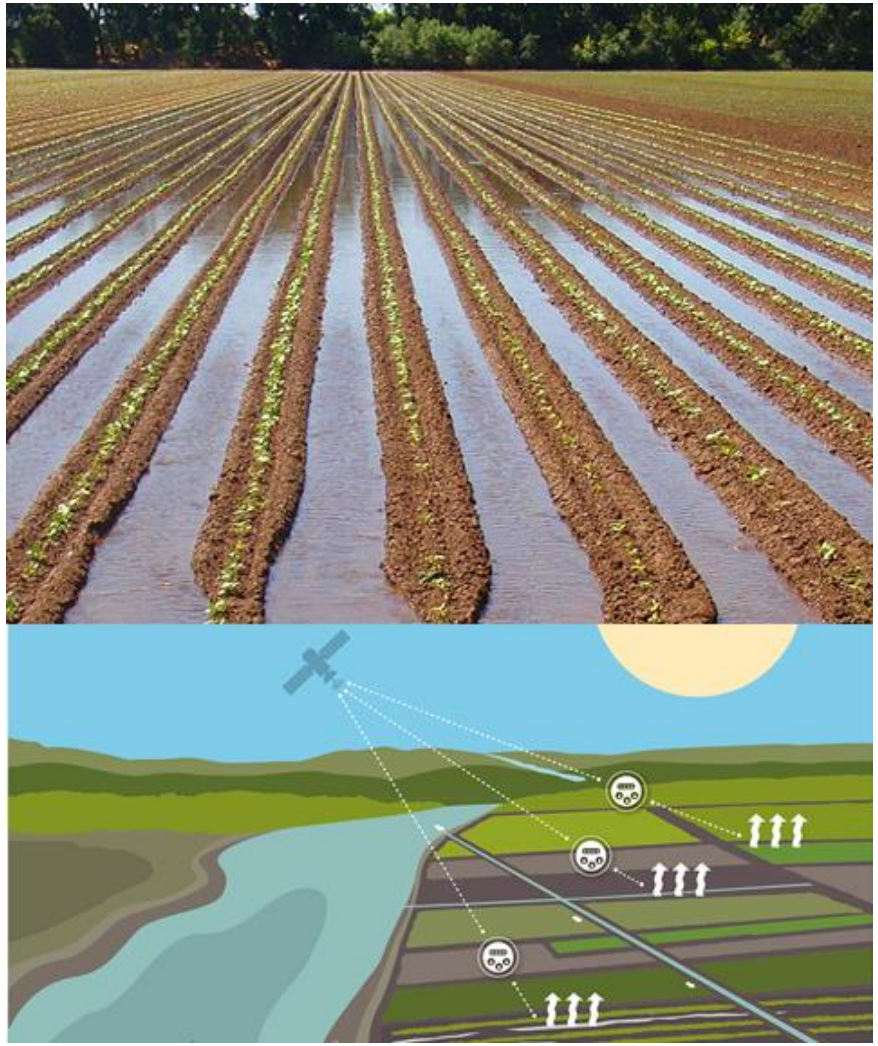
Google Earth Engine

DRI Desert Research Institute

We Need a Smart Meter for Irrigated Agriculture

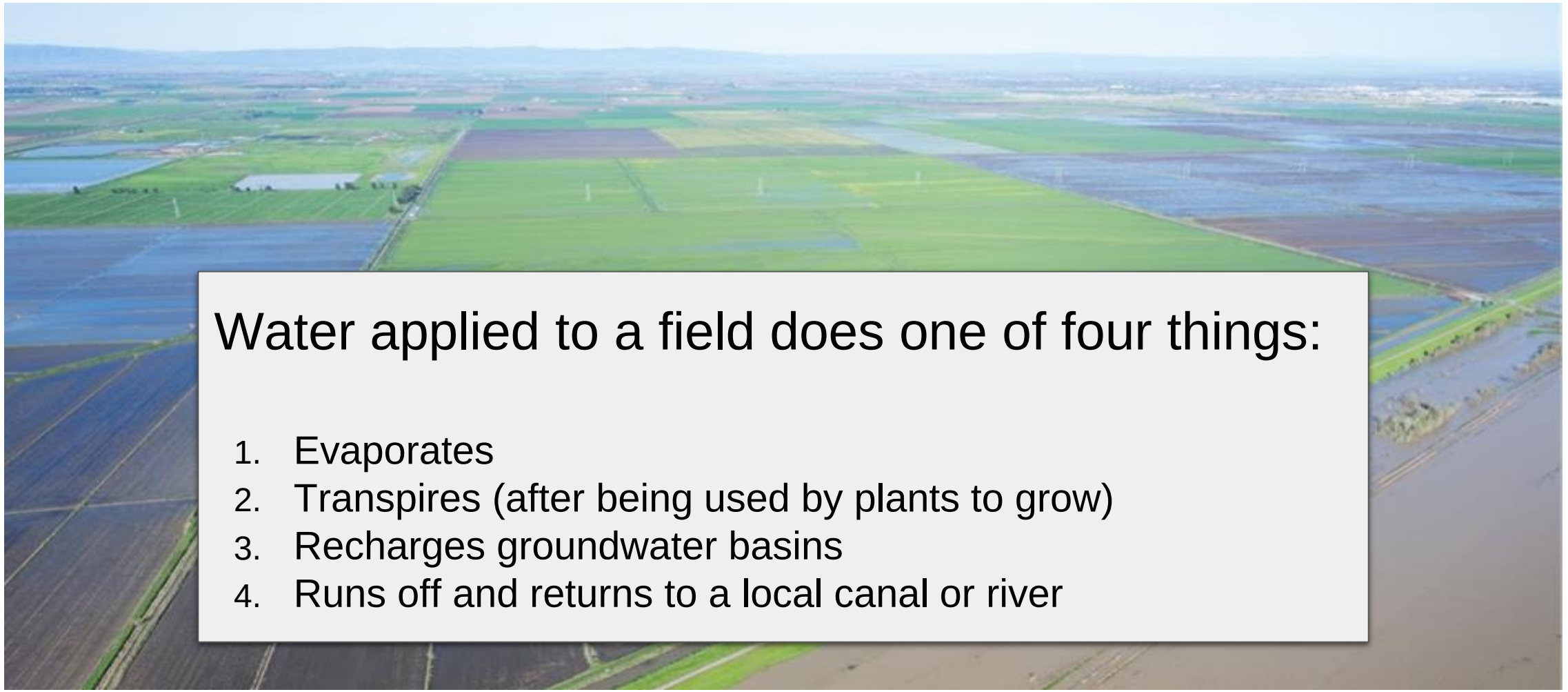
Measurement Enables Us to…

- Establish realistic water budgets
- Incentivize conservation and innovation
- Give proper credit for reduced use
- Reduce the transaction costs for water trading programs
- Increase urban and on-farm efficiencies



OPENET

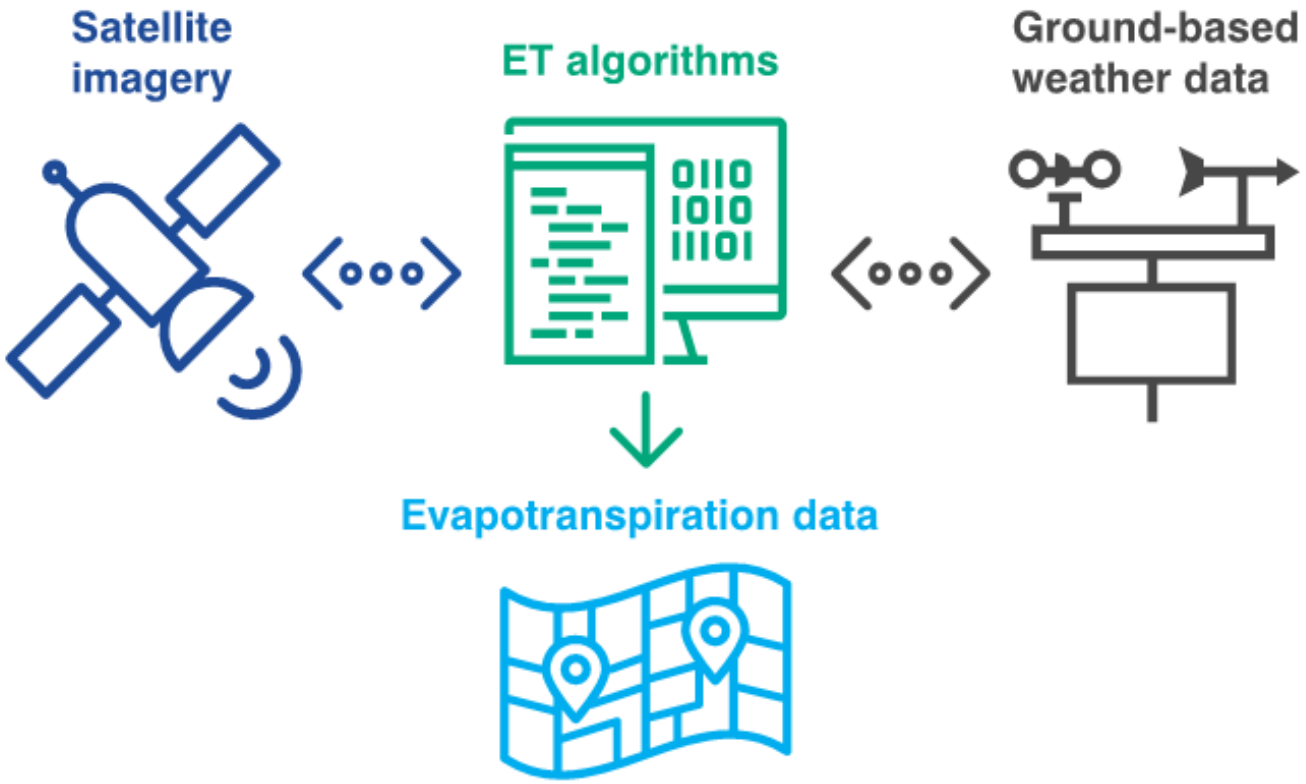
Water use in agriculture is challenging to measure

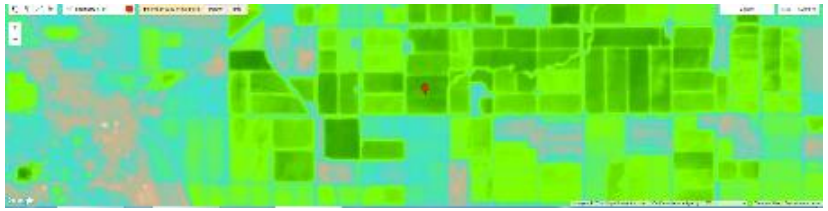


Water applied to a field does one of four things:

1. Evaporates
2. Transpires (after being used by plants to grow)
3. Recharges groundwater basins
4. Runs off and returns to a local canal or river

There is a proven method for measuring ET, but...





OPENET

Why is OpenET Needed?

Access to ET Information	Today	With OpenET
Cost	High	Low
Comparability and Trust	Variable	High
Scope	Limited	Broad
Accessibility	Low	High

OPENET

Project Goals: OpenET envisions a future in which...

Reliable ET data are produced and available at low cost, and **easily accessible via etdata.org** for any area within the Western US.

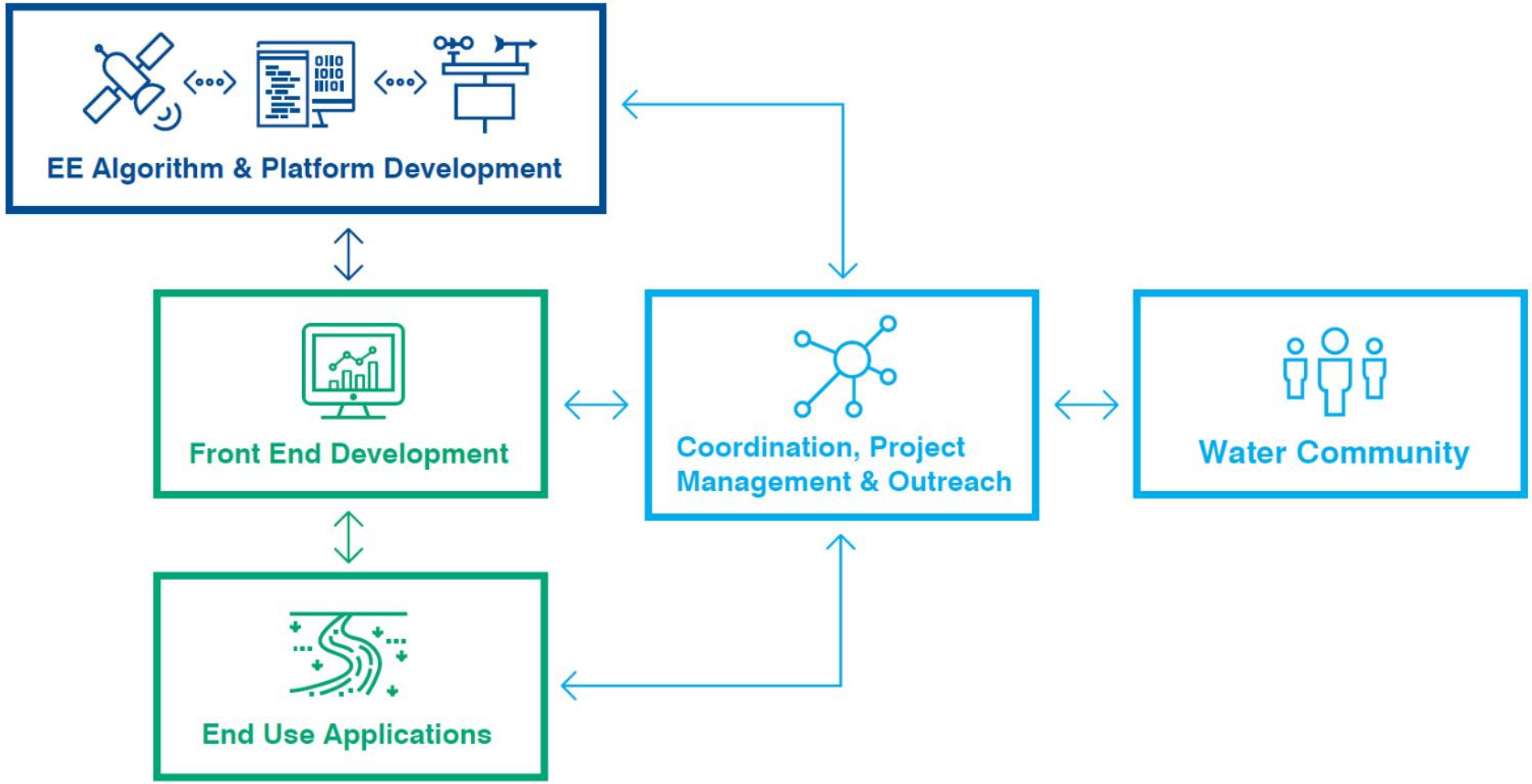
Project Goals: OpenET envisions a future in which...

There is trust in the validity of the data and information provided by the platform, and it is utilized by private and public resource managers at the local, state and federal levels.

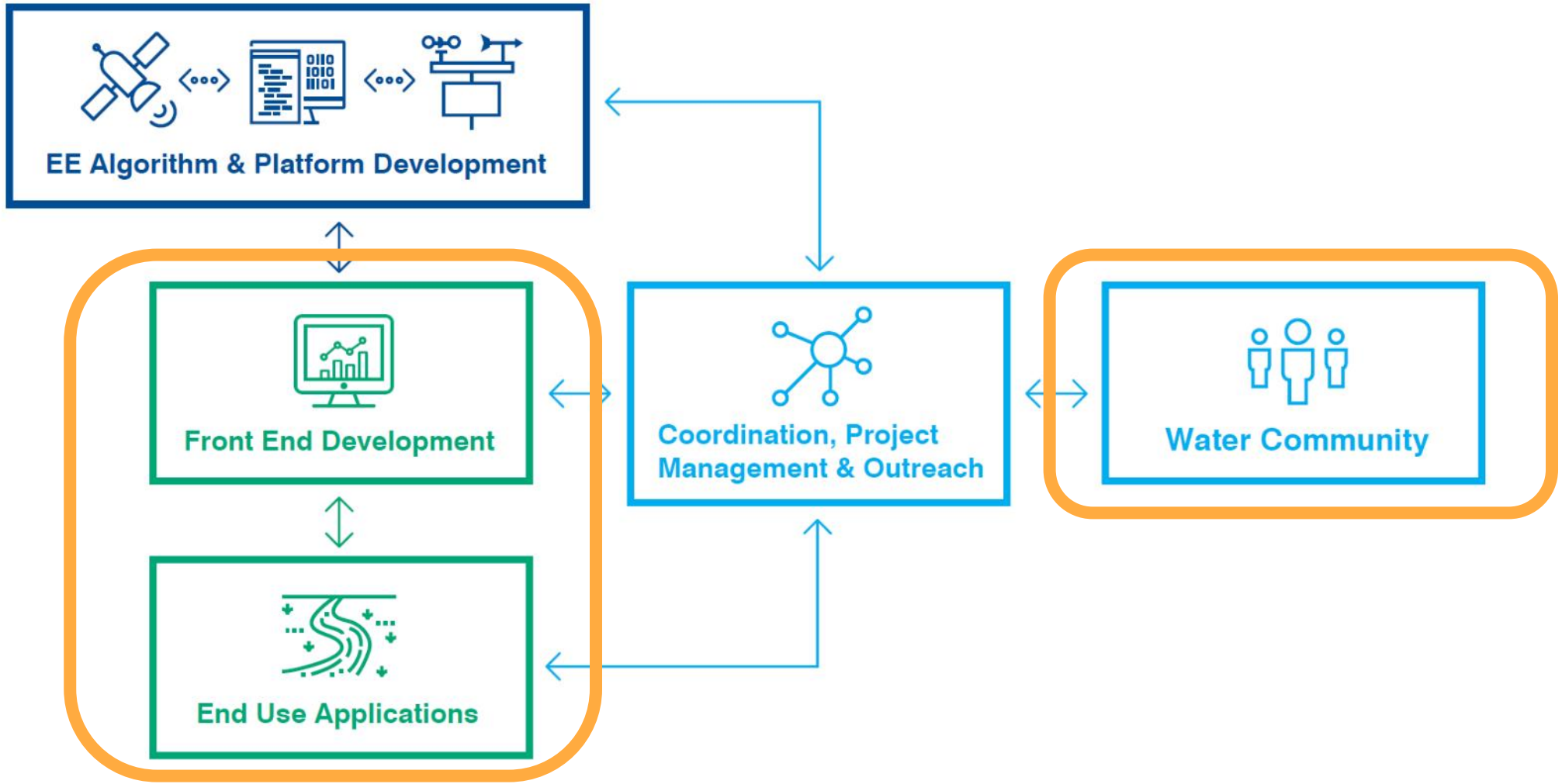
Project Goals: OpenET envisions a future in which...

A variety of **sustainable resource management practices are enabled** at a much larger scale than is currently possible

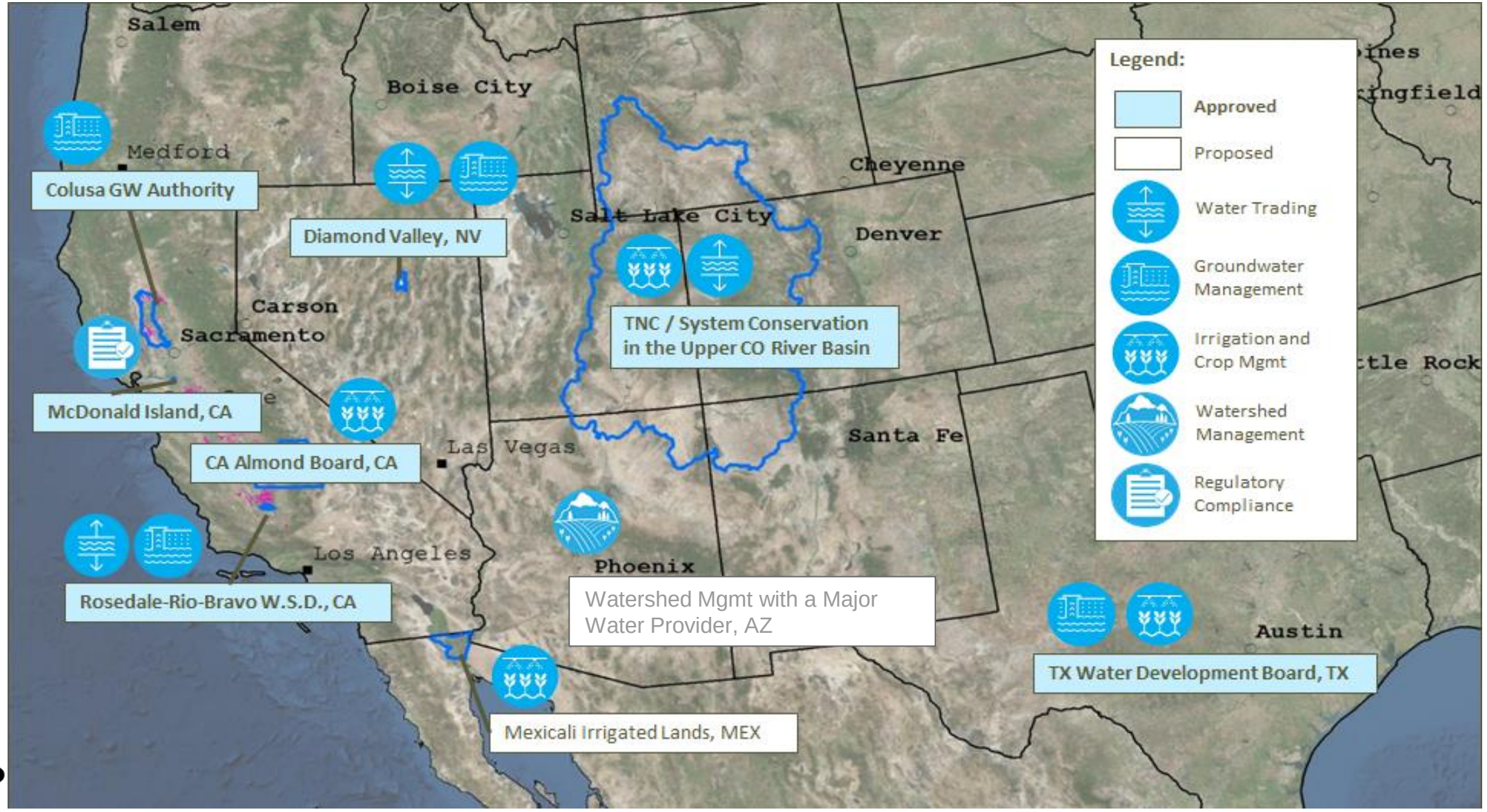
Project Design and Execution



Project Design and Execution



OpenET Use Cases will Guide Development



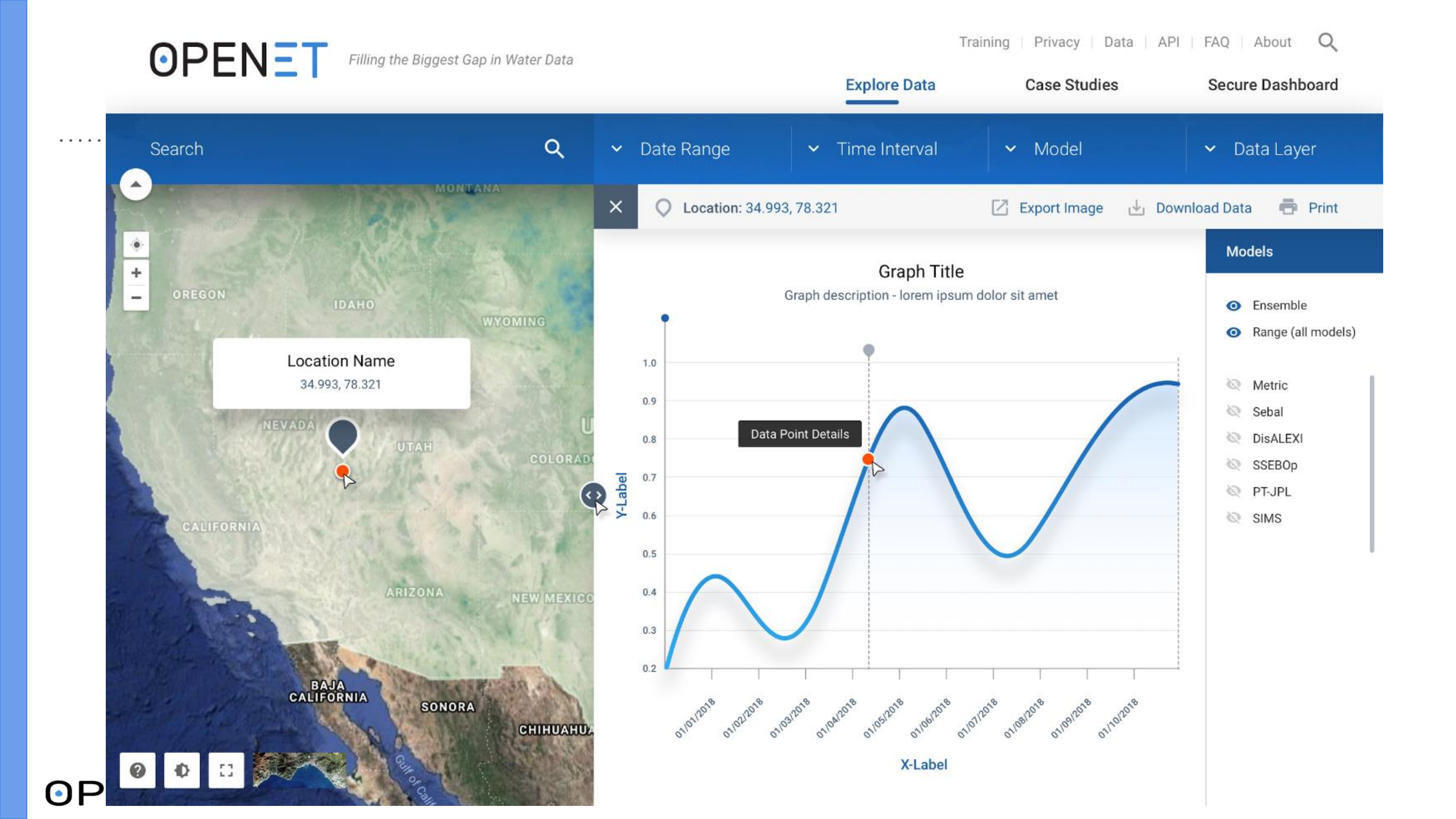
Partnering with experts to guide development

California Working Group - Organizations Represented

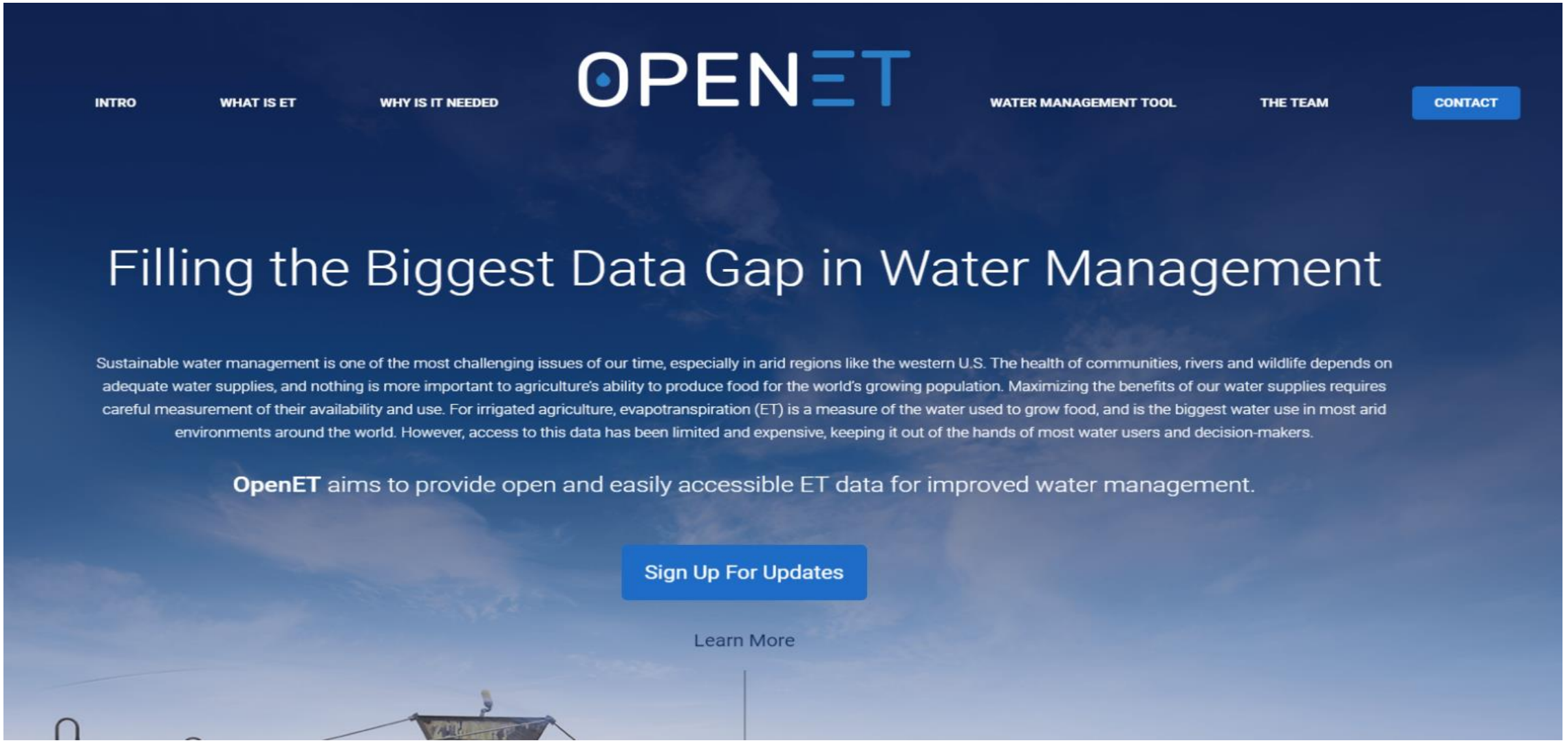
1. CA Farm Bureau Federation
2. CA Dept of Food and Ag
3. Sustainable Conservation
4. Gallo
5. CA State Water Resources Control Board
6. UC Ag Issues Center
7. David's Engineering
8. Governor's Office of Planning and Research
9. CA Dept of Water Resources

Colorado River Basin Working Group - Organizations Represented

1. Audubon
2. Wyoming Office of Engineers
3. Metropolitan Water District
4. Arizona Dept of Water Resources
5. Wilson Water Group
6. Utah State Univ.
7. Nevada Division of Water Resources
8. New Mexico Office of the State Engineer
9. US Bureau of Reclamation
10. Utah Division of Water Resources


OPENET
Filling the Biggest Gap in Water Data
Training | Privacy | Data | API | FAQ | About
Explore Data
Case Studies
Secure Dashboard
Search
Date Range
Time Interval
Model
Data Layer
Location: 34.993, 78.321
Export Image
Download Data
Print
Location Name
34.993, 78.321
MONTANA
OREGON
IDAHO
WYOMING
NEVADA
UTAH
COLORADO
CALIFORNIA
ARIZONA
NEW MEXICO
BAJA CALIFORNIA
SONORA
CHIHUAHUA
Graph Title
Graph description - lorem ipsum dolor sit amet
Data Point Details
Y-Label
X-Label
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
01/01/2018
01/02/2018
01/03/2018
01/04/2018
01/05/2018
01/06/2018
01/07/2018
01/08/2018
01/09/2018
01/10/2018
Models
Ensemble
Range (all models)
Metric
Sebal
DisALEXI
SSEBOp
PT-JPL
SIMS

Sign up for updates at etdata.org



OPENET

Contact

Robyn Grimm, PhD

Senior Manager, Water Information Systems

Environmental Defense Fund

rgrimm@edf.org

NATIONAL GOVERNORS ASSOCIATION

Networking Lunch

Tables will be organized by key topics, please find a seat at a table of interest to you


NGA
NATIONAL GOVERNORS ASSOCIATION

NATIONAL GOVERNORS ASSOCIATION

Small System Regionalization: Policies, Tools, & Technology to Meet Rural Water Needs

Olga Morales, New Mexico Regional Manager, Rural Community Assistance Corporation

Blanca Surgeon, Building Rural Economies Coordinator

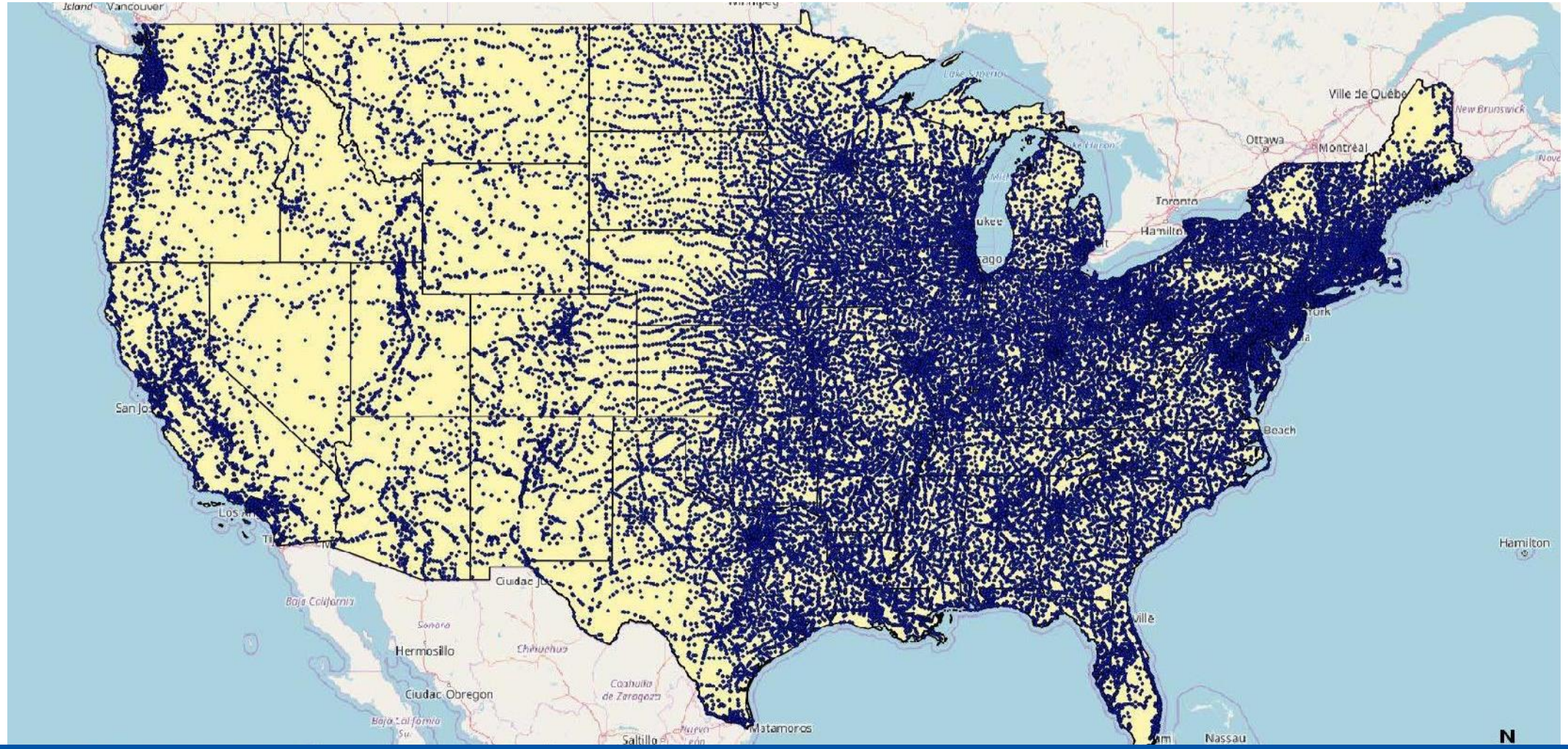
Rural Community Assistance Corporate

Moderator: Radhika Fox, Chief Operations Officer, U.S. Water Alliance

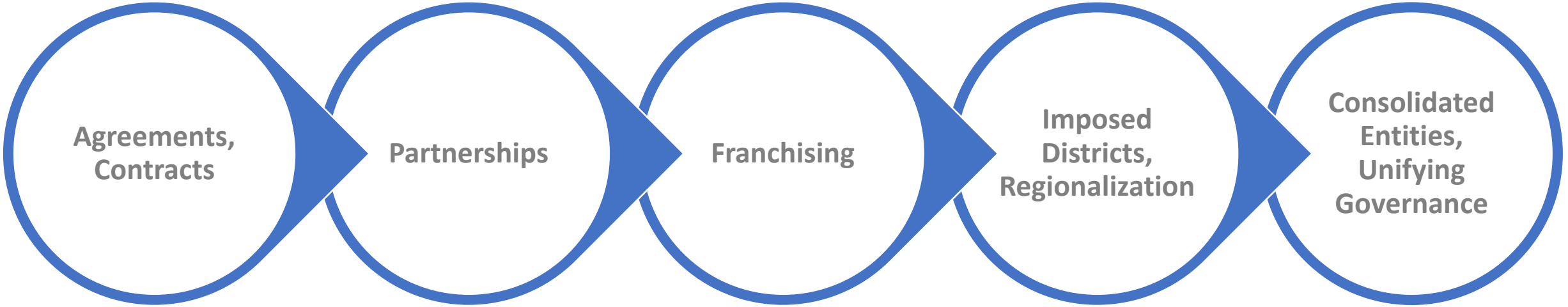
Small System Regionalization: Policies, Tools, and Technology to Meet Rural Water Needs

Radhika Fox
CEO, US Water Alliance
@radhikafox

The fragmented state of the water sector



A spectrum of solutions



Individual Utility Autonomy

Full Legal Consolidation

5 Guiding Principles:
Utility Strengthening Through Regionalization

Imagine a Day Without Water

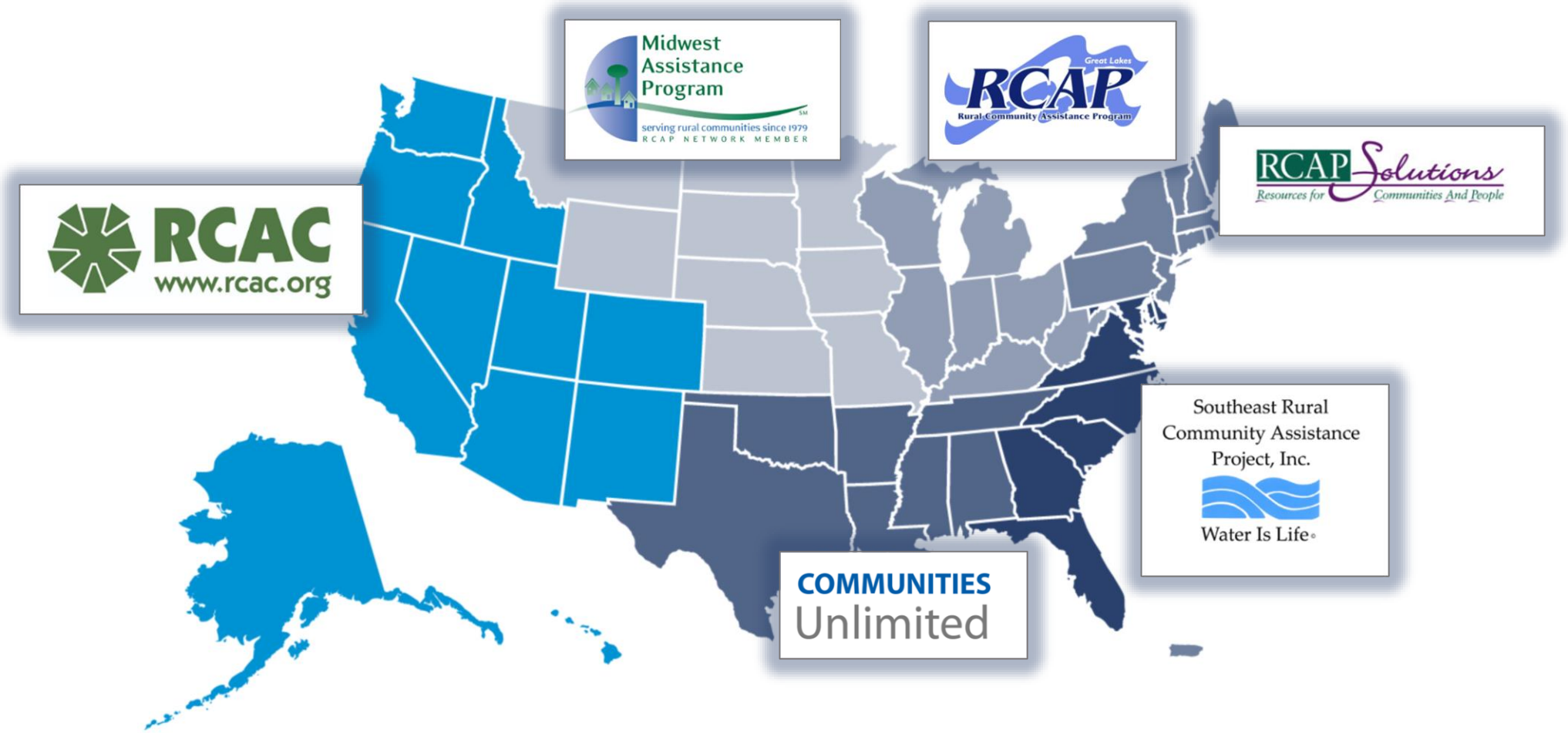
October 10, 2018

Imagineadaywithoutwater.org/signup

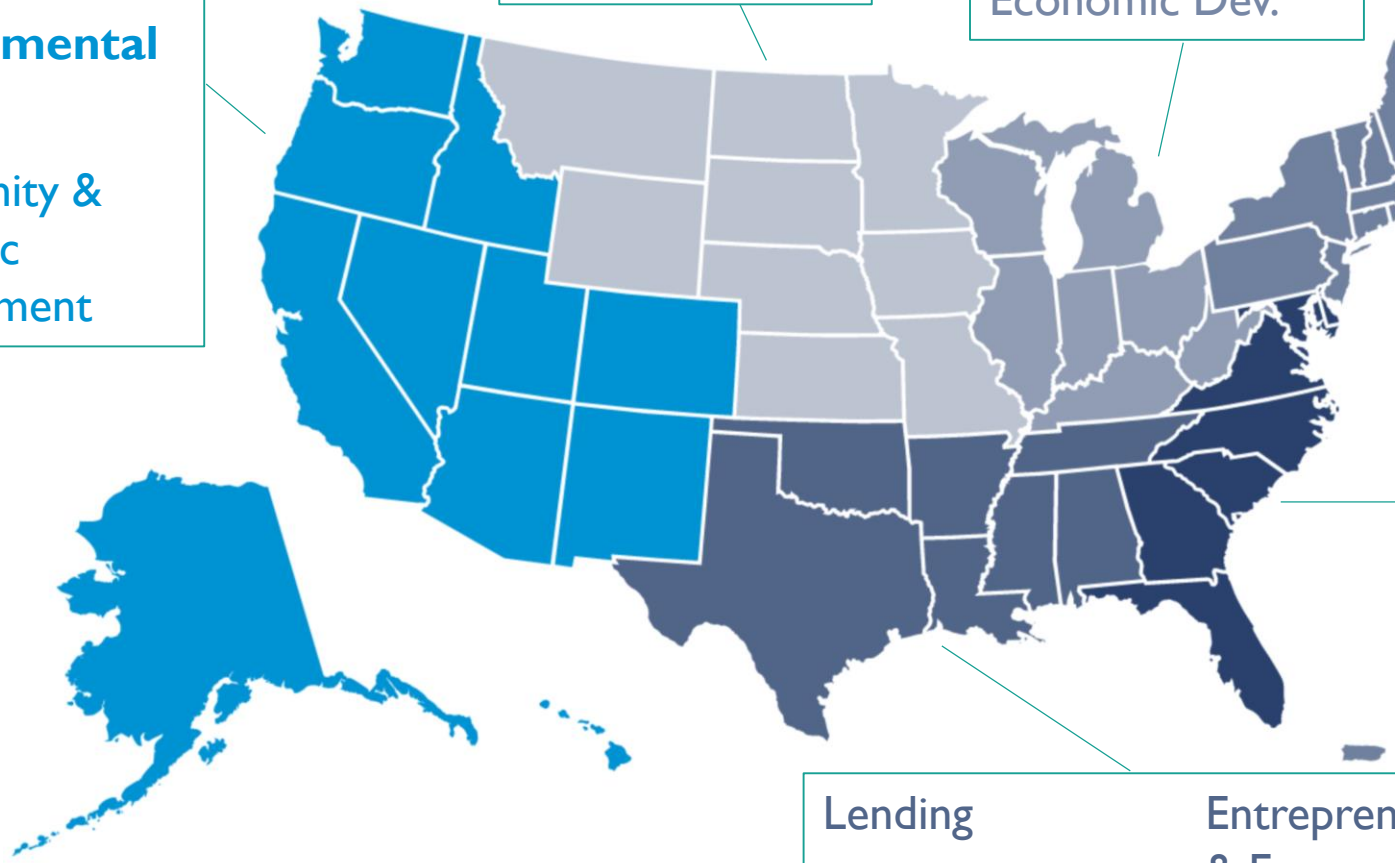
US Water Alliance

www.uswateralliance.org

Rural Community Assistance Partnership National Network



Services by Region



Lending
Environmental
Housing
Community & Economic Development

Environmental

Lending
Environmental
Housing
Community & Economic Dev.

Environmental
Housing

Environmental
Housing
Community Development

Lending
Environmental
Technical Support

Entrepreneurship & Economic Development

RCAP National Office Roles

Policy development, advocacy and applied research

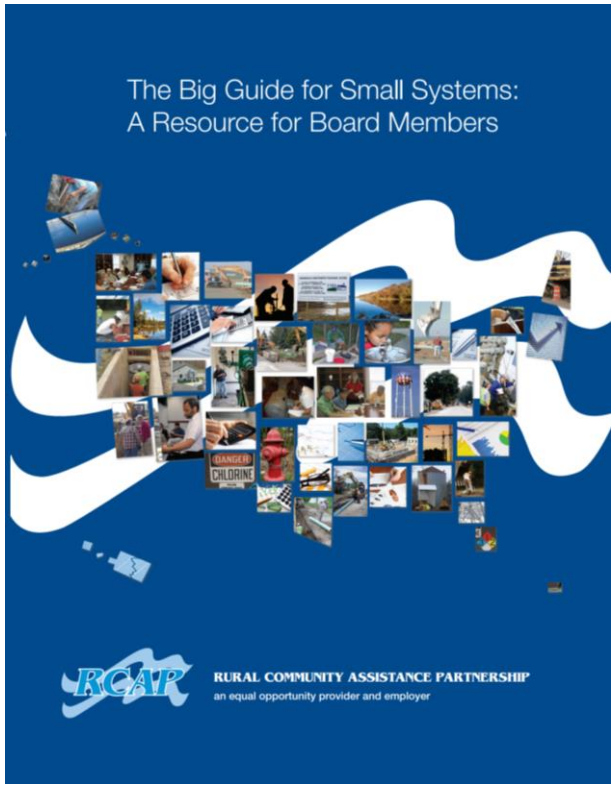
Partnerships and convening

Coordination of tools, training, best practices

Funder relationships, grants management and development

Communications

#ruralmatters



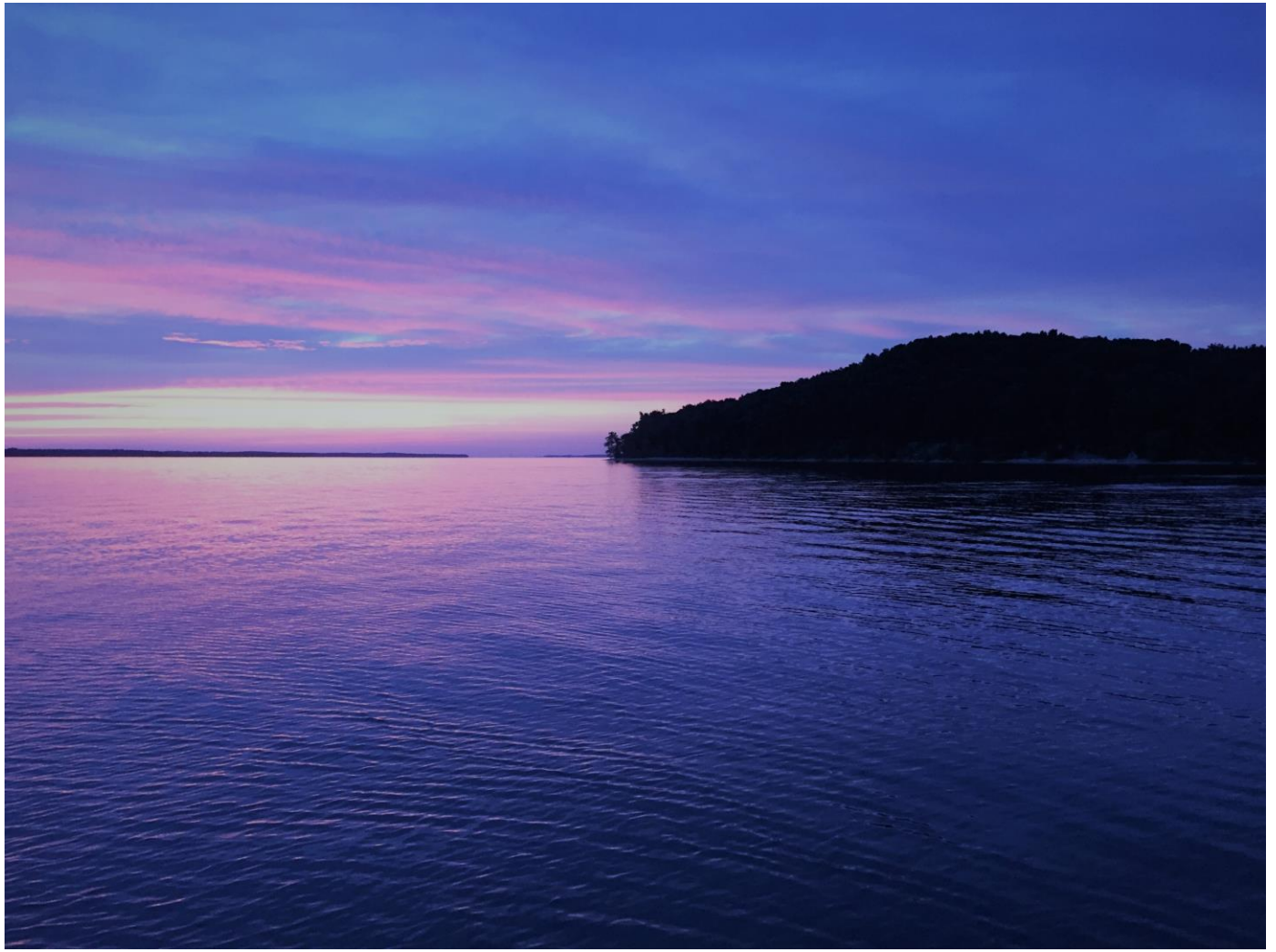
Forthcoming Research + Collaboration

RESEARCH

- **Regionalization**
  a national picture
- **Technical, Managerial and Financial Outcomes**

SUMMITS

- **NGA Water Policy**
- **Water Affordability**



RCAP National Photo Contest Winner 2018 (Landscape Category): Andrew Nordbye

Breakout Sessions

State Level Action to Address Drinking Water Contamination

Mike Zimmer, Cabinet Directors, Executive Office of Governor Rick Snyder

Alex Schaefer, Legislative Director, Government Relations, Natural Resources Committee, National Governors Association

Combatting the Cyber Threat to Water Infrastructure

Travis L. McLing
Energy Water and Chem-Bio Lead
Idaho National Laboratory
The Center for Advanced Energy Studies

Sarah Leeper
Vice President & General Council
California Americans Water, Hawaii American Water

NGA

NATIONAL GOVERNORS ASSOCIATION

Finance Innovation: Using Environmental Impact Bonds to Attract Private Capital & Share Performance Risk

Eric Letsinger
Chief Executive Officer
Quantified Ventures

Moderator: Benjamin H. Grumbles, Secretary of Environment, Maryland


NGA
NATIONAL GOVERNORS ASSOCIATION

NATIONAL GOVERNORS ASSOCIATION

2018 Water Policy Institute

Day 2: September 12, 2018

NATIONAL GOVERNORS ASSOCIATION

Beneficial Uses of Stormwater & Reducing the Cost of Pollution Controls

Annalisa Kihara, STORMS Unit Chief, Division of Water Quality, California State Water Resources Control Board

Kara M. Boyles, City Engineer, City of South Bend

Dr. Stephen Weisberg, Executive Director, Southern California Costal Water Research Project

Moderator: Bevin Buchheister, National Governors Association

Stormwater Capture and Use in California

2018 Annual Water Policy Institute

September 12, 2018

Annalisa Kihara, PE
STORMS Unit Chief
Division of Water Quality

Presentation Outline

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

1. Setting the Stormwater Stage
2. How the California Water Boards are rethinking stormwater management – Stormwater Strategy (STORMS)
3. Efforts Supporting Stormwater Capture and Use in California

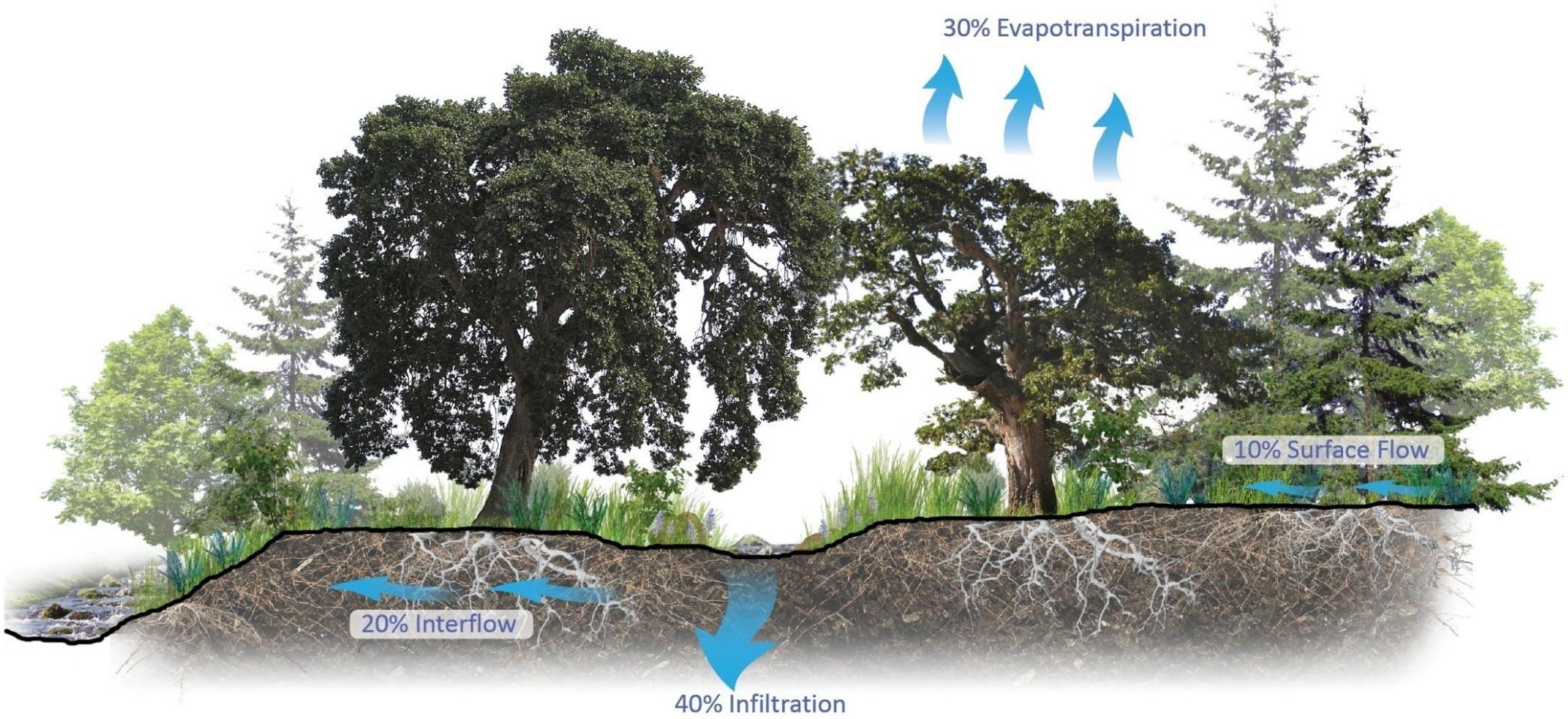
STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

PART 1
Setting the Stormwater Stage

Setting the Stormwater Stage

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

Hydrologic Cycle in the Natural Landscape



Setting the Stormwater Stage

Hydrologic Cycle in the Urban Environment

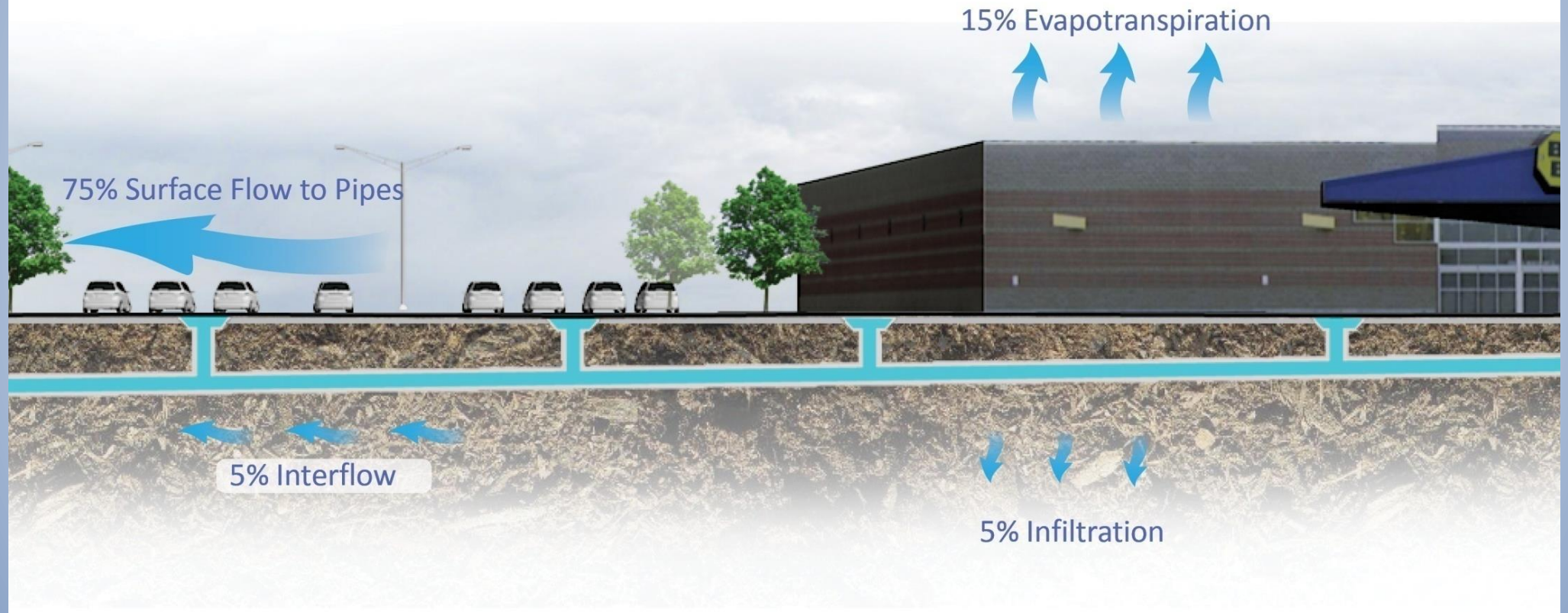


Photo: Nevue Ngan Associates

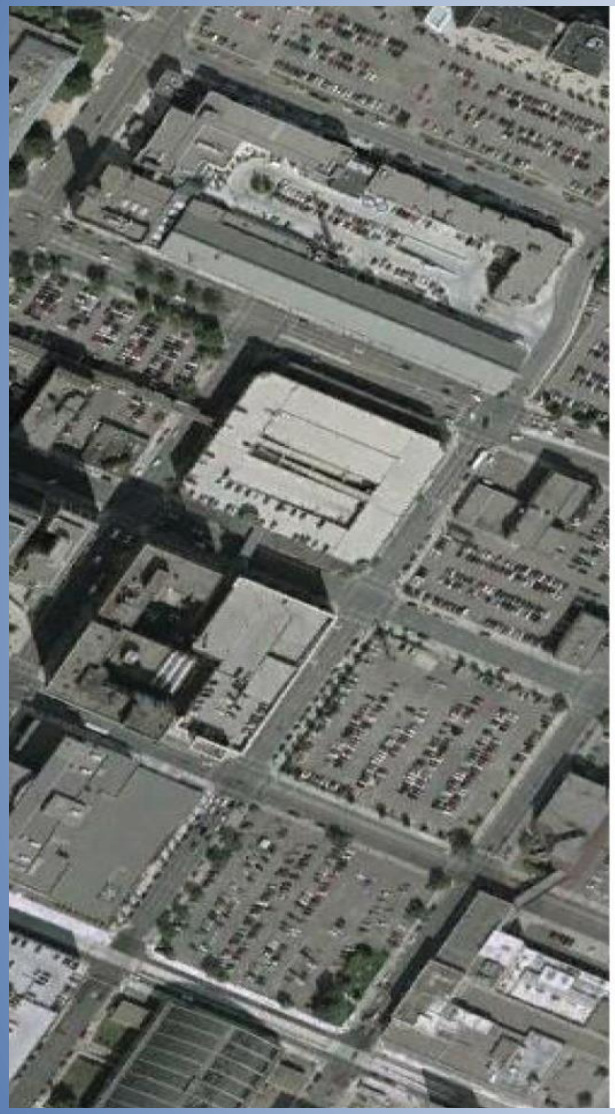
Setting the Stormwater Stage

Stormwater Runoff Mobilizes Contaminants

To name a few…

- Trash
- Sediments
- Metals
- Nutrients
- Oil and Grease
- Pesticides
- Temperature

Setting the Stormwater Stage




Conventional Management Devalues Water

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

PART 2
California Water Boards – Rethinking Stormwater Management

Revisit to Stormwater Management

California drought

Continued **water quality issues**

California Water Action Plan (2014)- calls for multi-benefit stormwater solutions

Photo: Kevin Robert Perry

Storm Water Strategy

Vision:

Storm Water is sustainably managed and utilized in California to support water quality and water availability for human uses as well as the environment.

Mission:

To lead the evolution of storm water management in California by **advancing the perspective that storm water is a valuable resource**, supporting policies for collaborative watershed-level storm water management and pollution prevention, removing obstacles to funding, developing resources, and integrating regulatory and non-regulatory interests.

Photo: Kevin Robert Perry

Storm Water Strategy

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

Change the perspective of storm water from a nuisance or hazard…

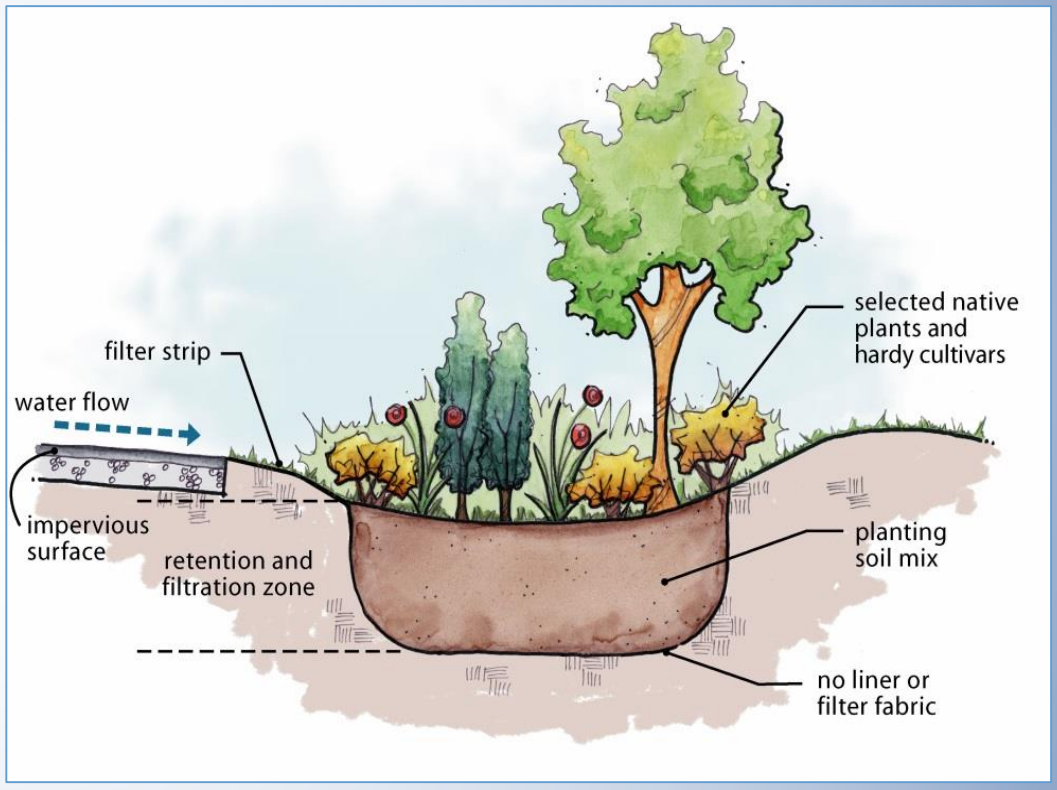
The Day After Tomorrow, 2004

Storm Water Strategy

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

…to a valuable water resource

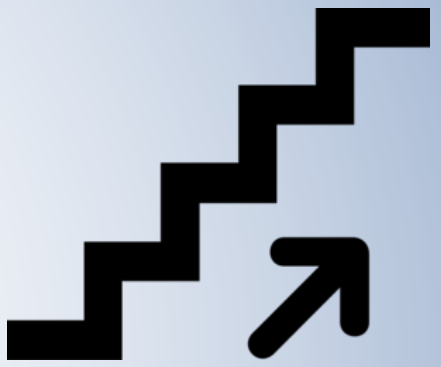
elkhartriverrestorationassociation.org



betterground.org

Storm Water Strategy

Projects – 23 Total



PHASE I PROJECTS

- Deliverables and project completion targeted within 4 years of initiation

PHASE II PROJECTS

- Scope and priority will be influenced by lessons learned from Phase I
- Targeted for completion within 8 years of initiating the program

PHASE III PROJECTS

- Targeted for completion within 12 years of initiation the program

Phase I Projects

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

Phase I Projects
1. Promote Stormwater Capture and Use
2. Eliminate Barriers to Storm Water Capture and Use
3. Develop Guidance for Alternative Compliance Approaches
4. Develop Watershed-Based Compliance and Management Guidelines and Tools
5. Implement Senate Bill 985
6. Eliminate Barriers to Funding Stormwater Programs
7. Storm Water Program “Open Data”
8. Urban Pesticides Amendments
9. Opportunities for Source Control and Pollution Prevention

STORMS
STORM WATER STRATEGY
CALIFORNIA WATER BOARDS

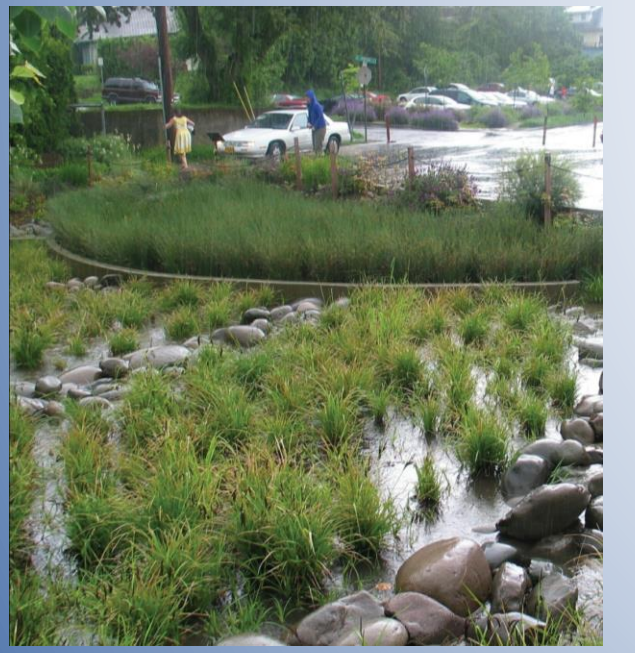
PART 3
Efforts Supporting Stormwater Capture and Use in California

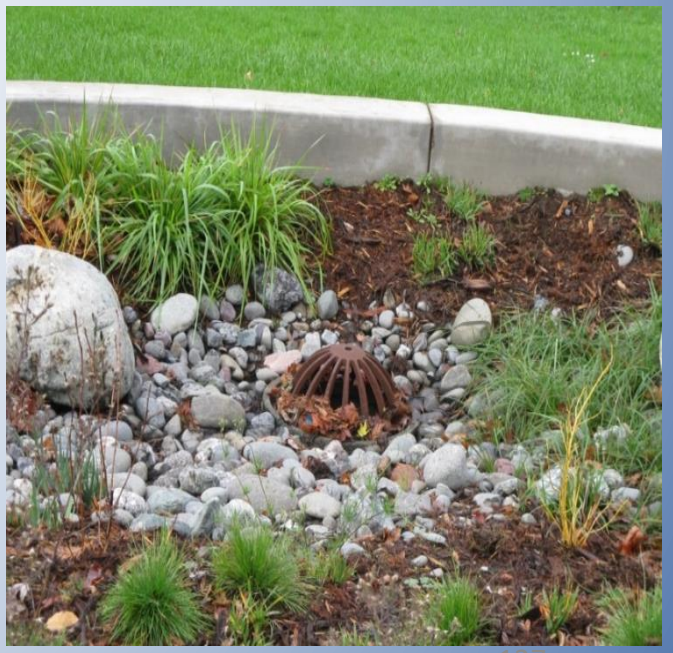
Stormwater Capture and Use

Stormwater capture and use is important in California:

- Stormwater represents a local and underutilized source
  - Dry weather flow and wet weather (storm) events can represent a significant source of water
    - Potentially over 600,000 acre feet per year (NRDC, Pacific Institute, 2014)
- Reduces pollutant loading in waterways
- Restores depleted aquifers
- Restores natural watershed processes
- Provide for more sustainable water supplies

Common Practices





Other Technologies – Dry Wells

Siting –

- Distance from drinking water wells

Performance Design –

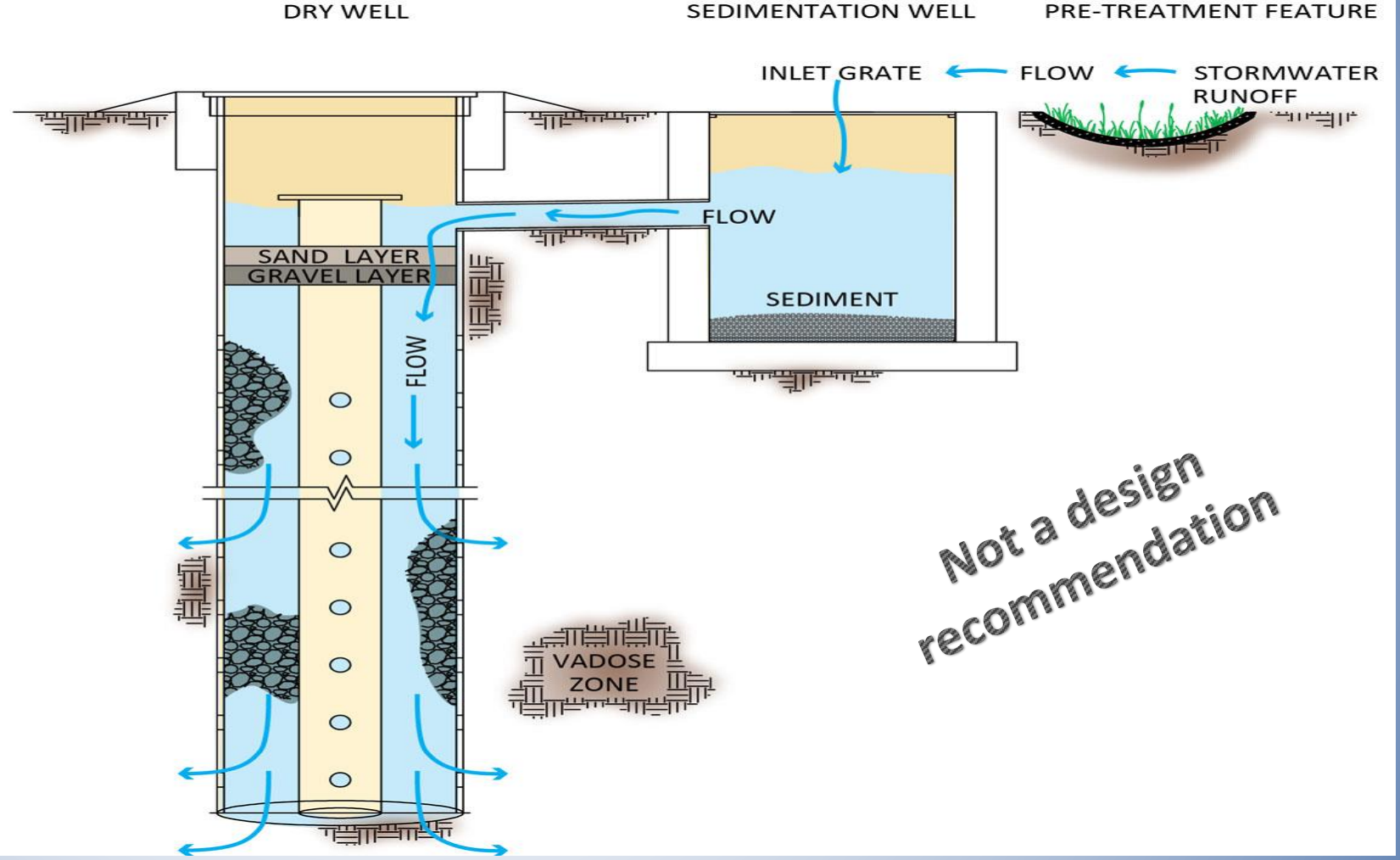
- Infiltration rate

Maintenance -

- Cleaning

Monitoring –

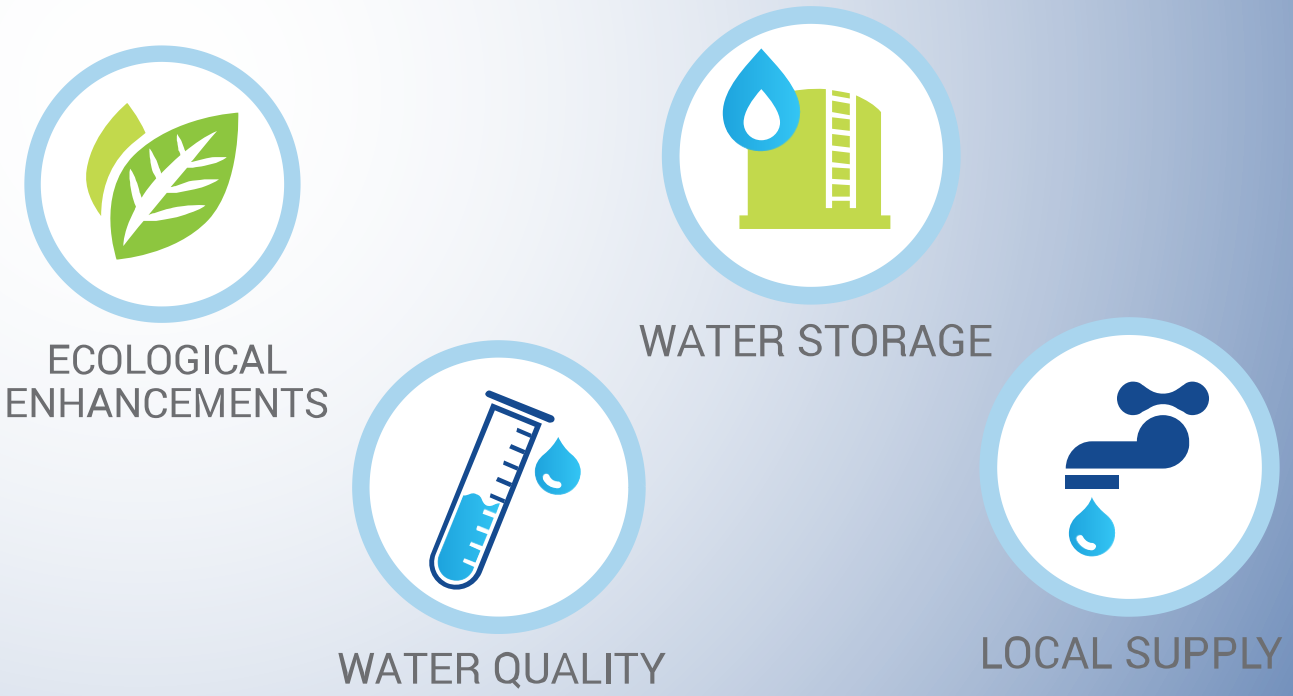
- Which contaminants to measure and how often

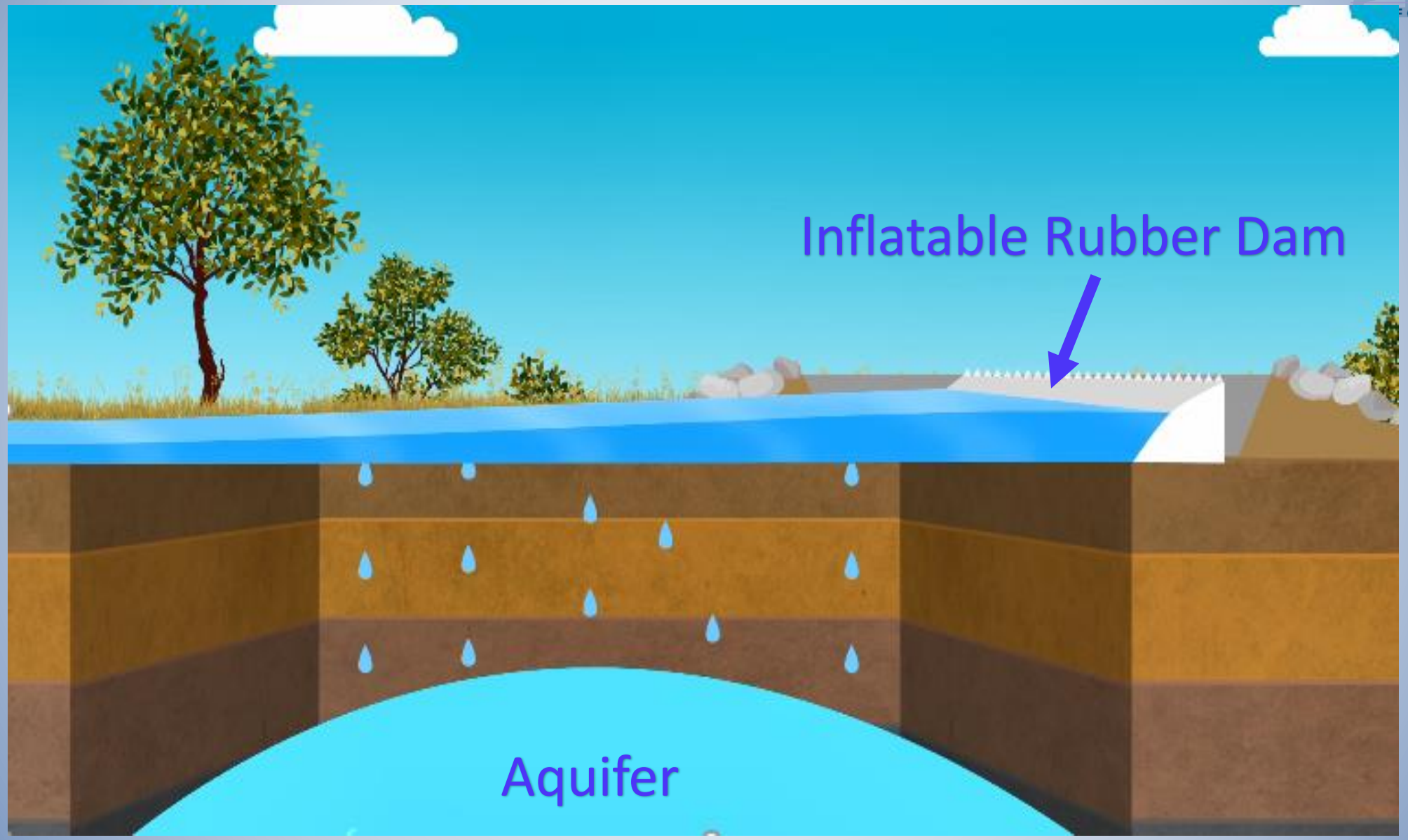


Funding Stormwater Programs

CA Water Board Grant & Loan Programs

- Proposition 1 Storm Water Grant Program – Multi-Benefit
  - $200 million in matching grants (Planning & Implementation)
- Annual Clean Water Act section 319(h) Nonpoint Source Funding
- Clean Water State Revolving Fund
  - Low Interest Financing
- **Drinking Water State Revolving Fund**
  - Low Interest Financing
  - Pilot: San Juan Watershed Project
    - Santa Margarita Water District
    - South Coast Water District
  - New Water: 500 – 1,400 AFY




Inflatable Rubber Dam
Aquifer

Funding Stormwater Programs

Other Efforts

- Public-Private Partnerships
  - Example: Culver City Costco parking lot expansion
    - City of Los Angeles, City of Culver & Costco Wholesale Corporation
- Outreach material on stormwater program needs and benefits
  - Messaging to public and elected officials

“We always hope for the easy fix: the one simple change that will erase a problem in a stroke. But few things in life work this way. Instead, success requires making a hundred small steps go right – one after the other, no slipups, no goofs, everyone pitching in.”

- Atul Gawande; Better: A Surgeon’s Notes on Performance

waterboards.ca.gov/STORMS

Annalisa Kihara, Unit Chief

Strategy to Optimize Resource Management of Stormwater

Annalisa.Kihara@waterboards.ca.gov

(916) 324-6786

Reinventing CSO Solutions

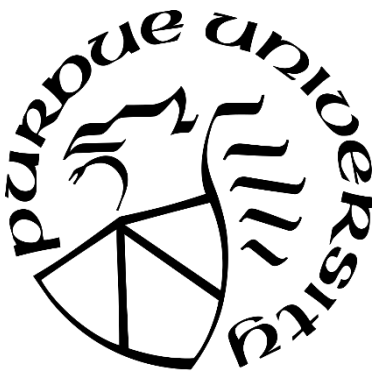
City of South Bend

National Governors Association
September 12, 2018

CITY OF SOUTH BEND
PUBLIC WORKS

Smart Sewer Technology: Background

- City – University – Industry Partnership
- Funded in 2004 by the Indiana Economic Development Corp.
- Goal: Use brightest minds and latest technology to solve the CSO problem
- Resources:
  - $2,000,000
  - 7 Professors: (EE, CE, CE)
  - 14 Grad. Students
  - City of South Bend
  - 2 National CE Firms
  - EmNet, LLC



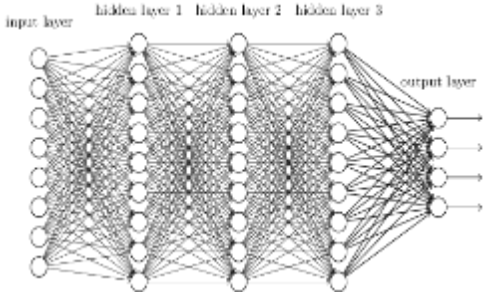
Smart Sewer Technology: Overview

Let’s maximize what we have!

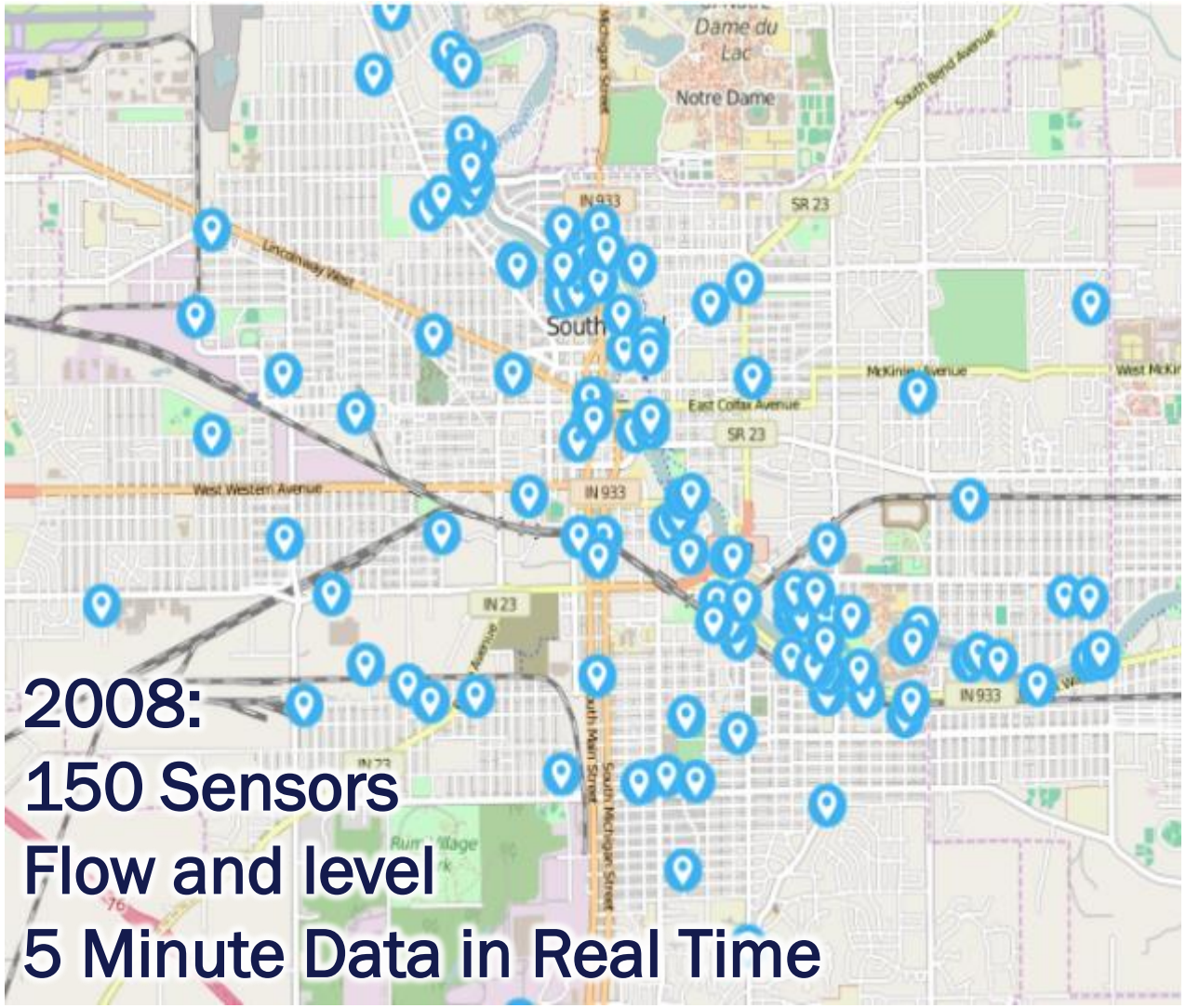
Internet of Things/ Edge Computing

Big Data Analytics

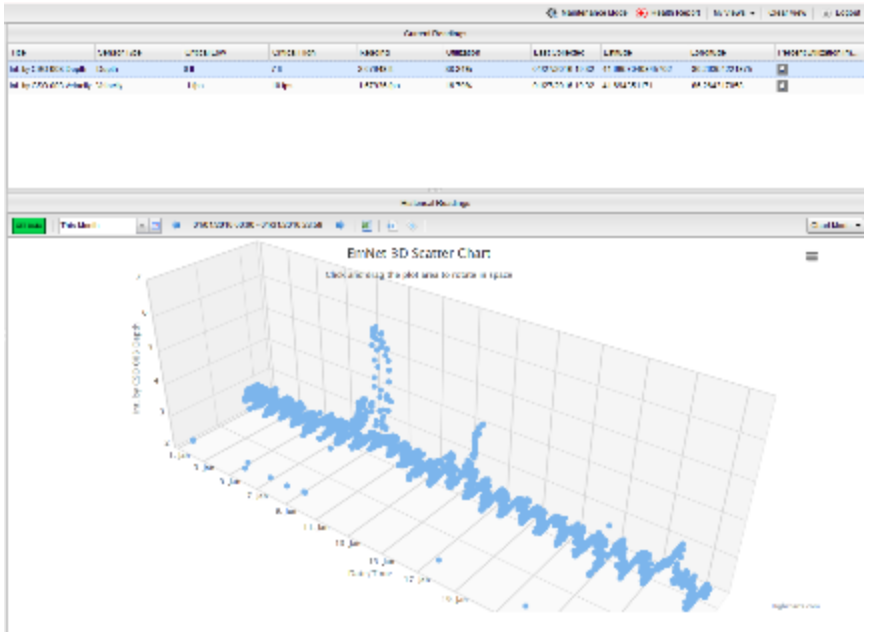
Machine Learning

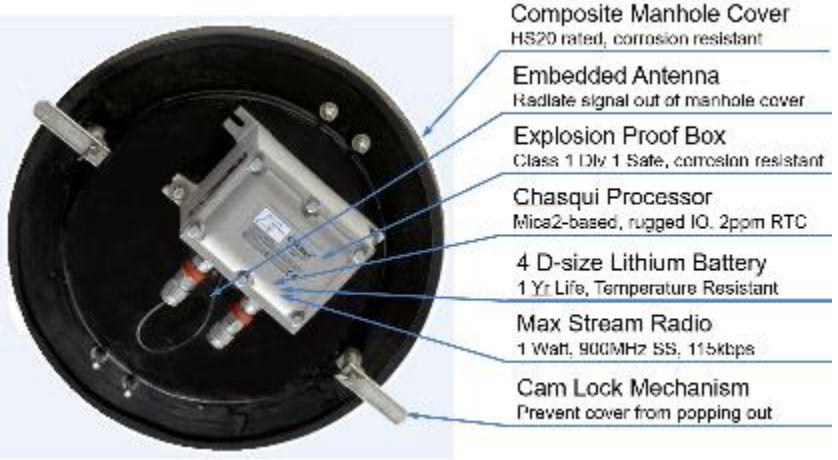


#1 Turn on the lights

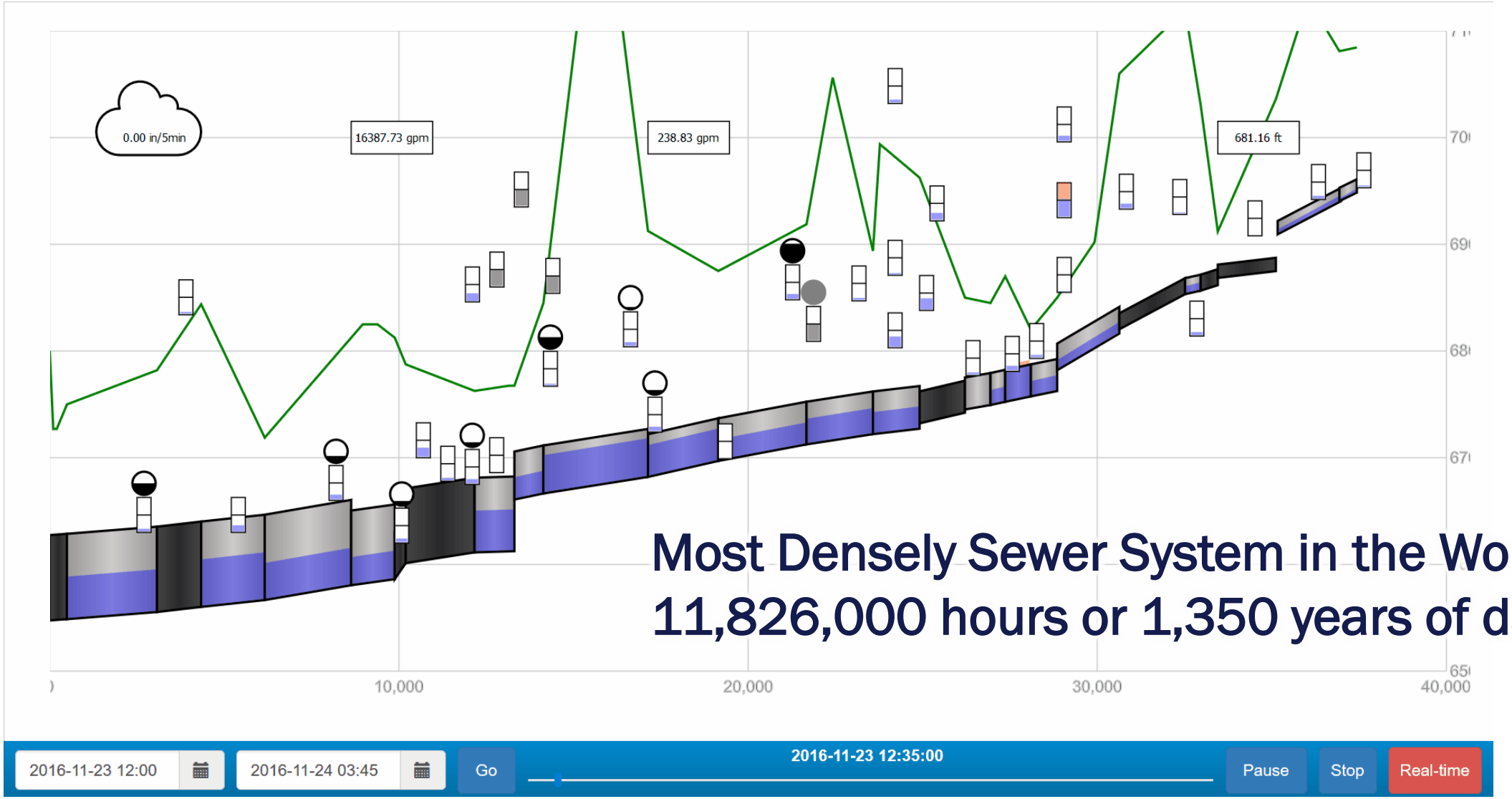


2008:
150 Sensors
Flow and level
5 Minute Data in Real Time





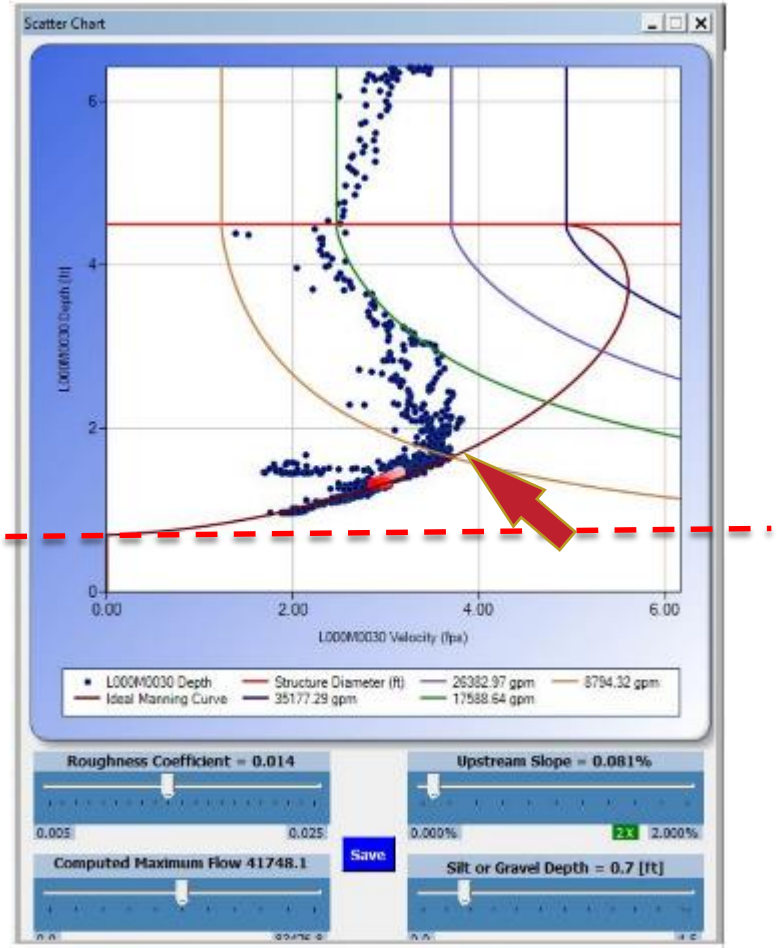
#1 Turn on the lights



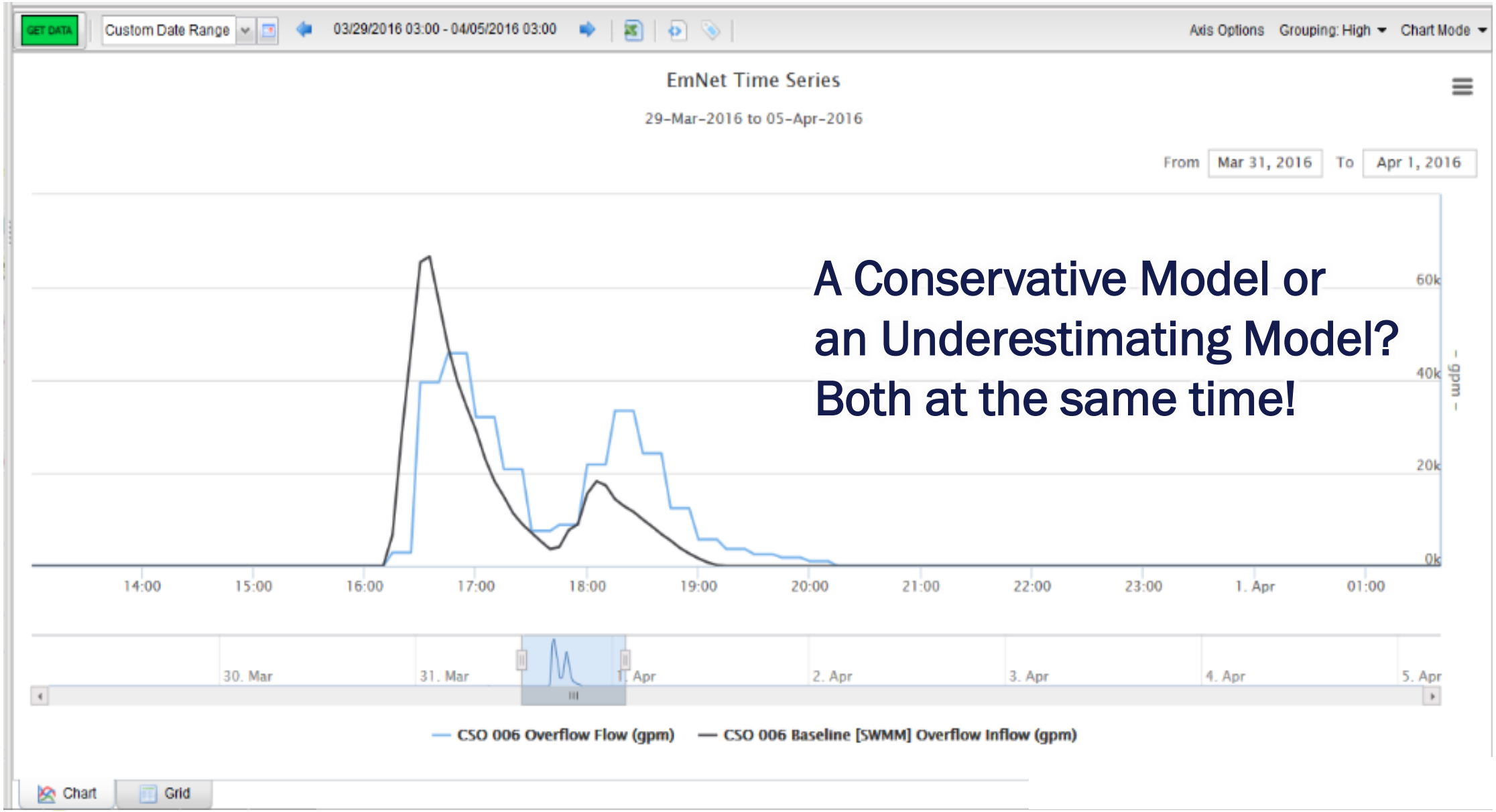
Most Densely Sewer System in the World

11,826,000 hours or 1,350 years of data

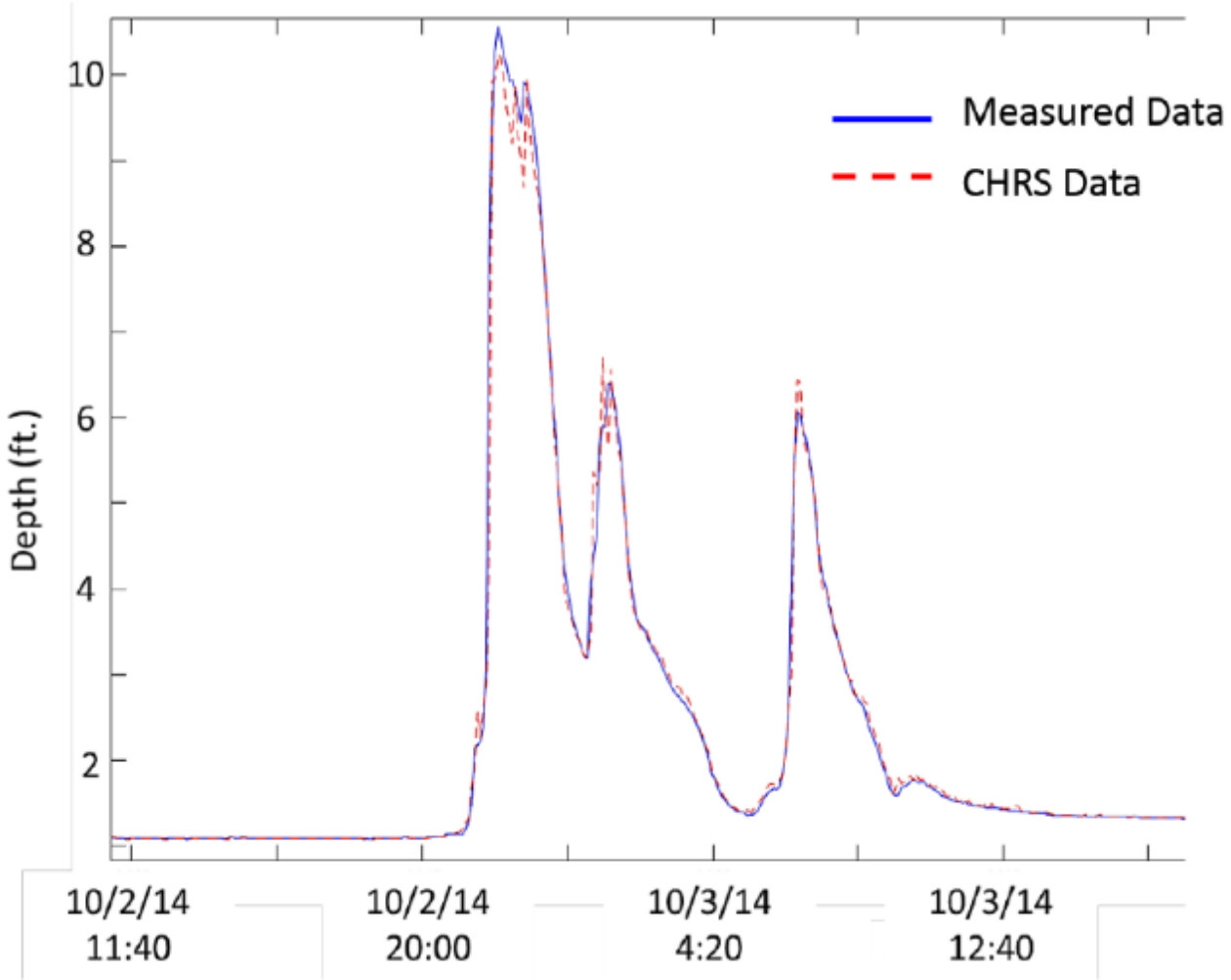
#1 Turn on the lights



Modelling; the basis of a LTCP

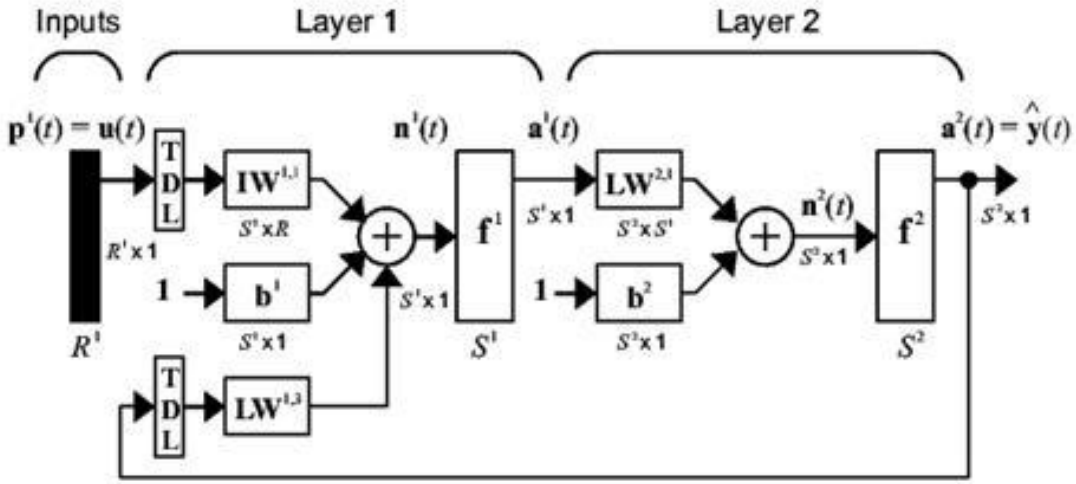


Better Modelling- using real, gathered data.

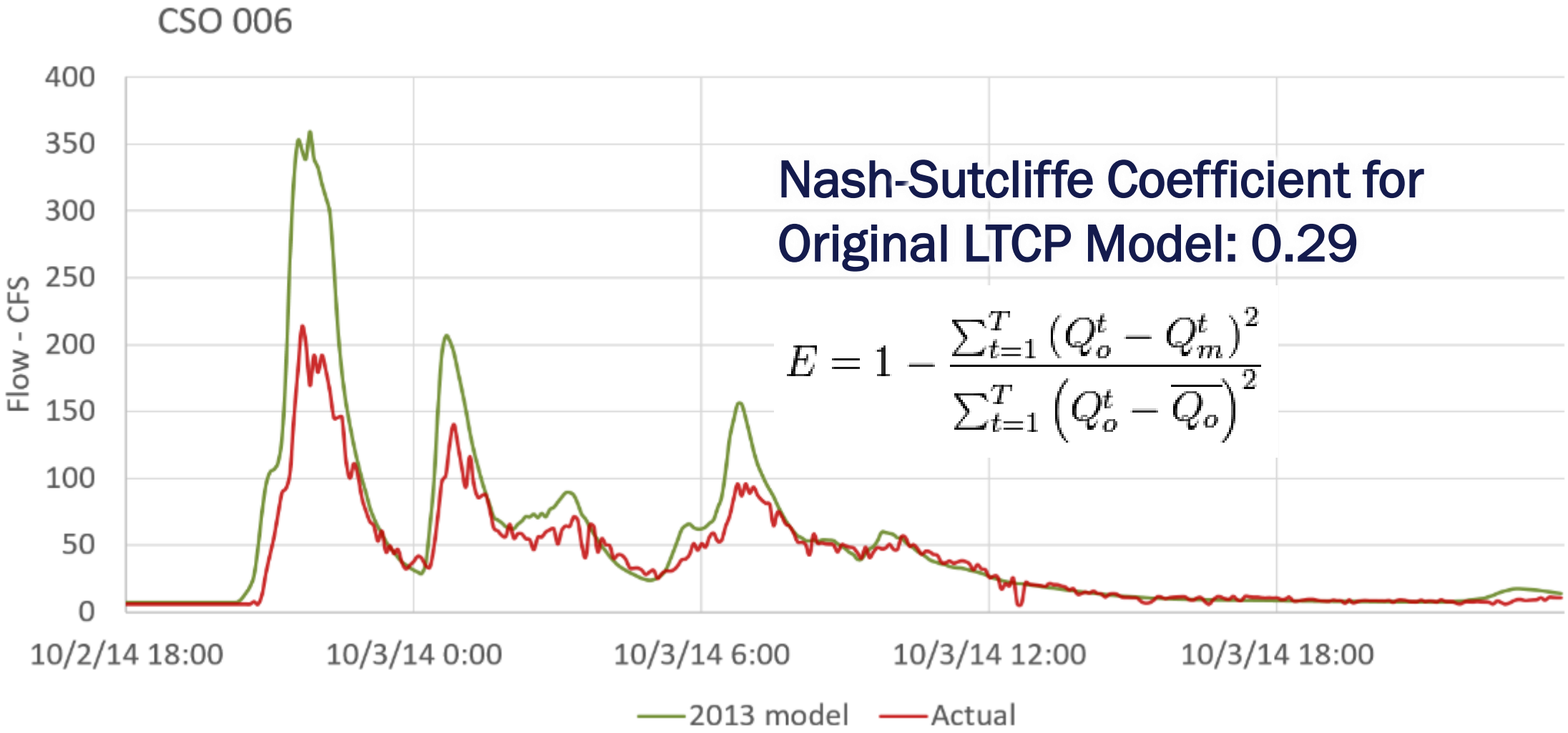


CHRS:
Cognitive Hydraulic Response System

- Uses Artificial Intelligence to create a self-learning, self-calibrating hydraulic model.
- Built in SWMM



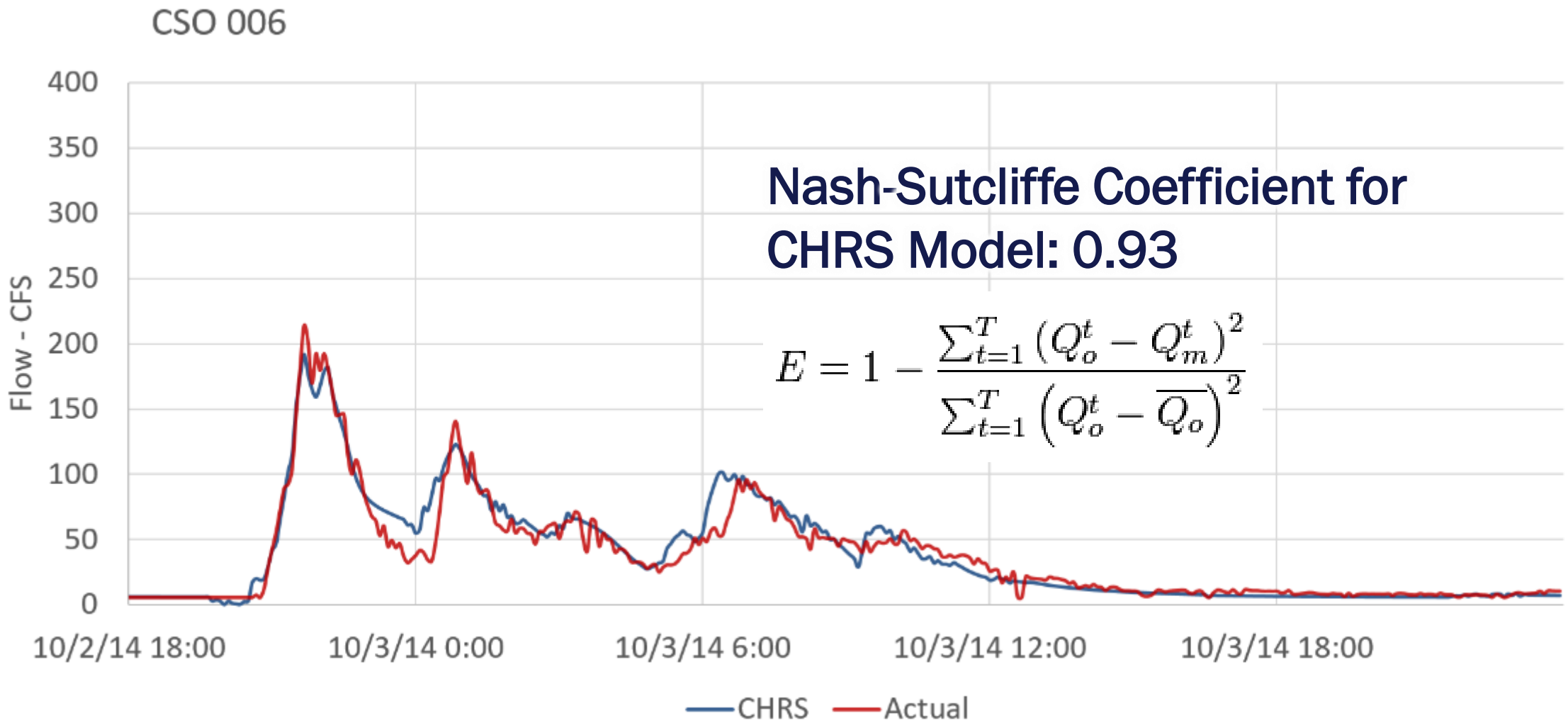
Existing LTCP Model



Nash-Sutcliffe Coefficient for Original LTCP Model: 0.29

$$E = 1 - \frac{\sum_{t=1}^{T} \left(Q_o^t - Q_m^t\right)^2}{\sum_{t=1}^{T} \left(Q_o^t - \overline{Q_o}\right)^2}$$

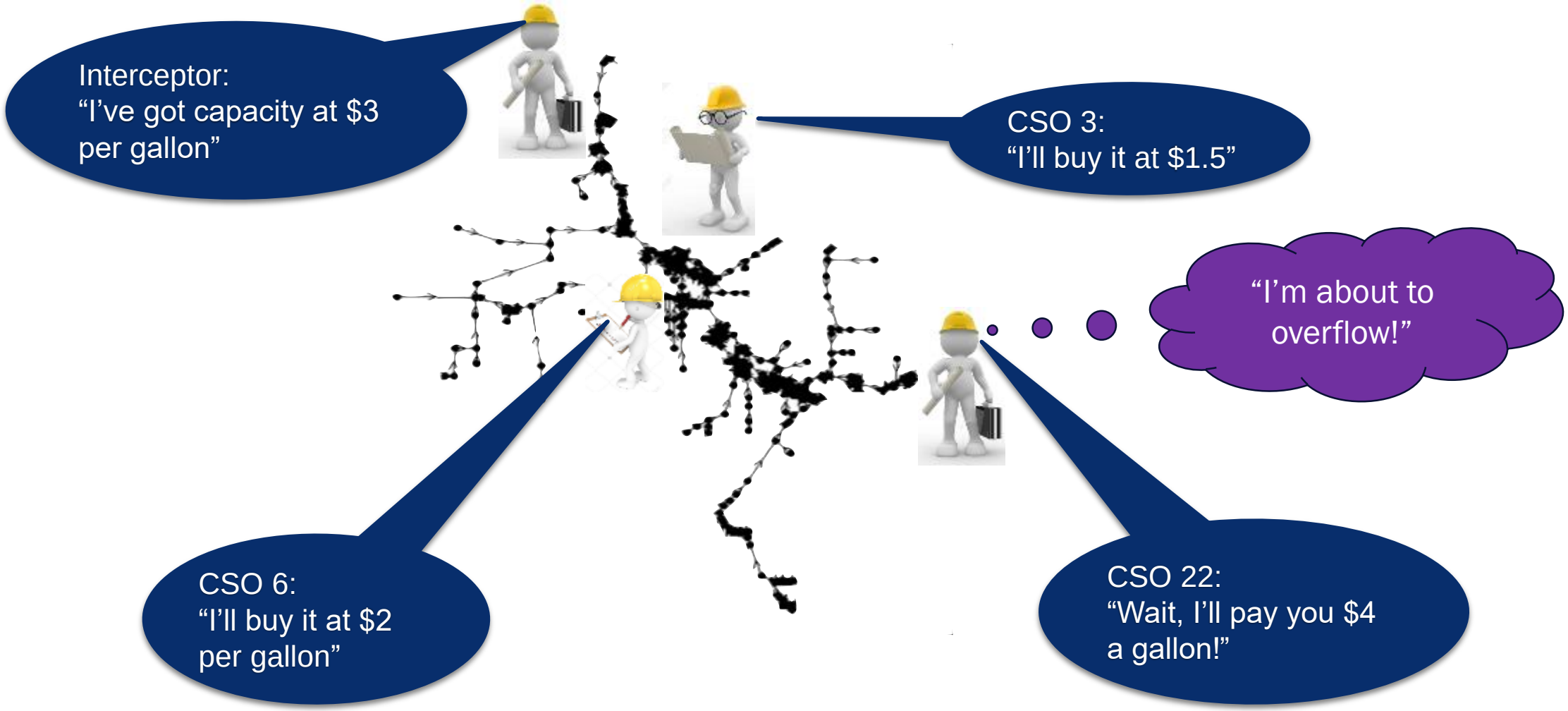
Our new smart sewer derived Model



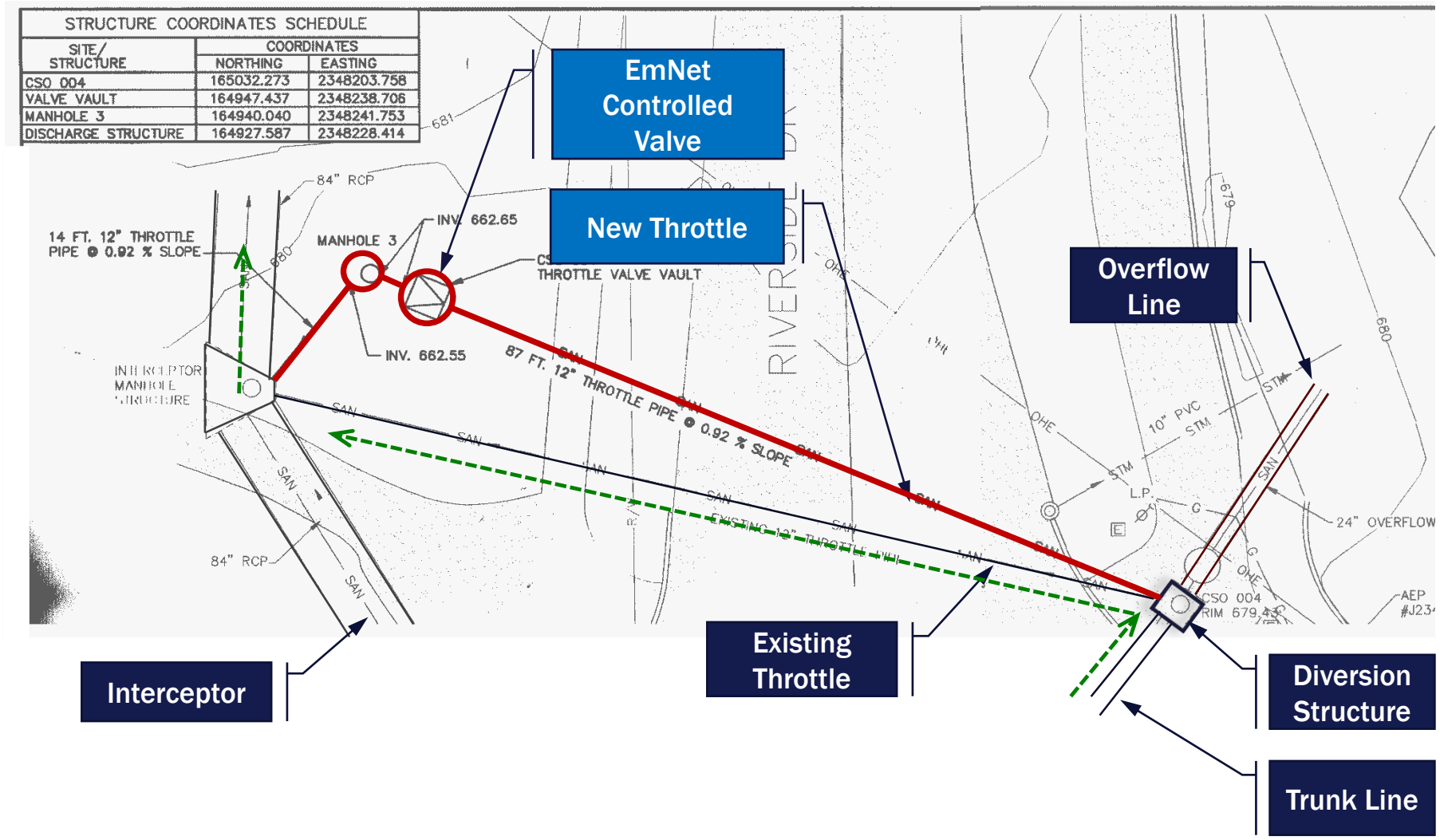
Nash-Sutcliffe Coefficient for CHRS Model: 0.93

$$E = 1 - \frac{\sum_{t=1}^{T} \left(Q_o^t - Q_m^t\right)^2}{\sum_{t=1}^{T} \left(Q_o^t - \overline{Q_o}\right)^2}$$

#3 Operate the Sewershed



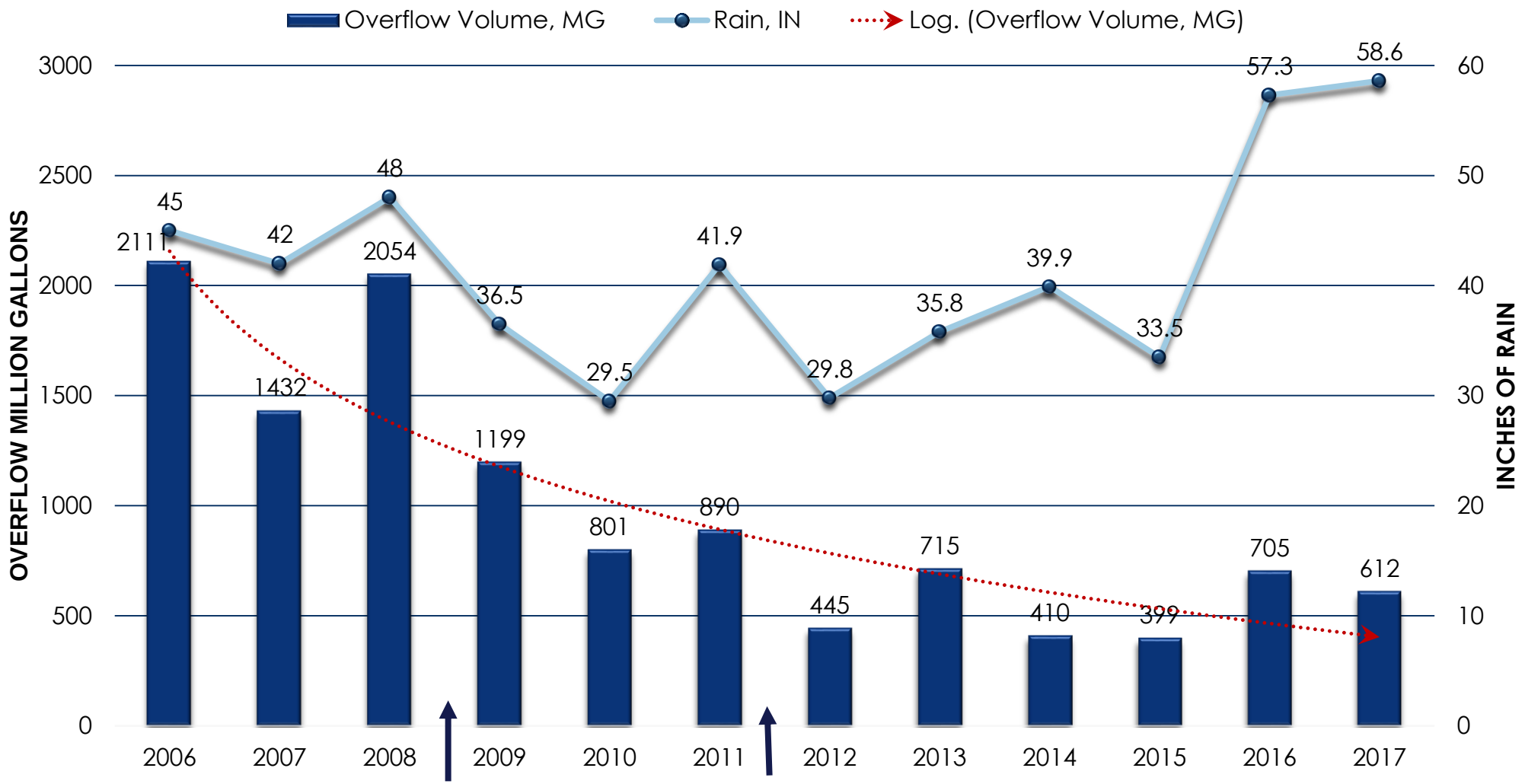
#3 Operate the Sewershed



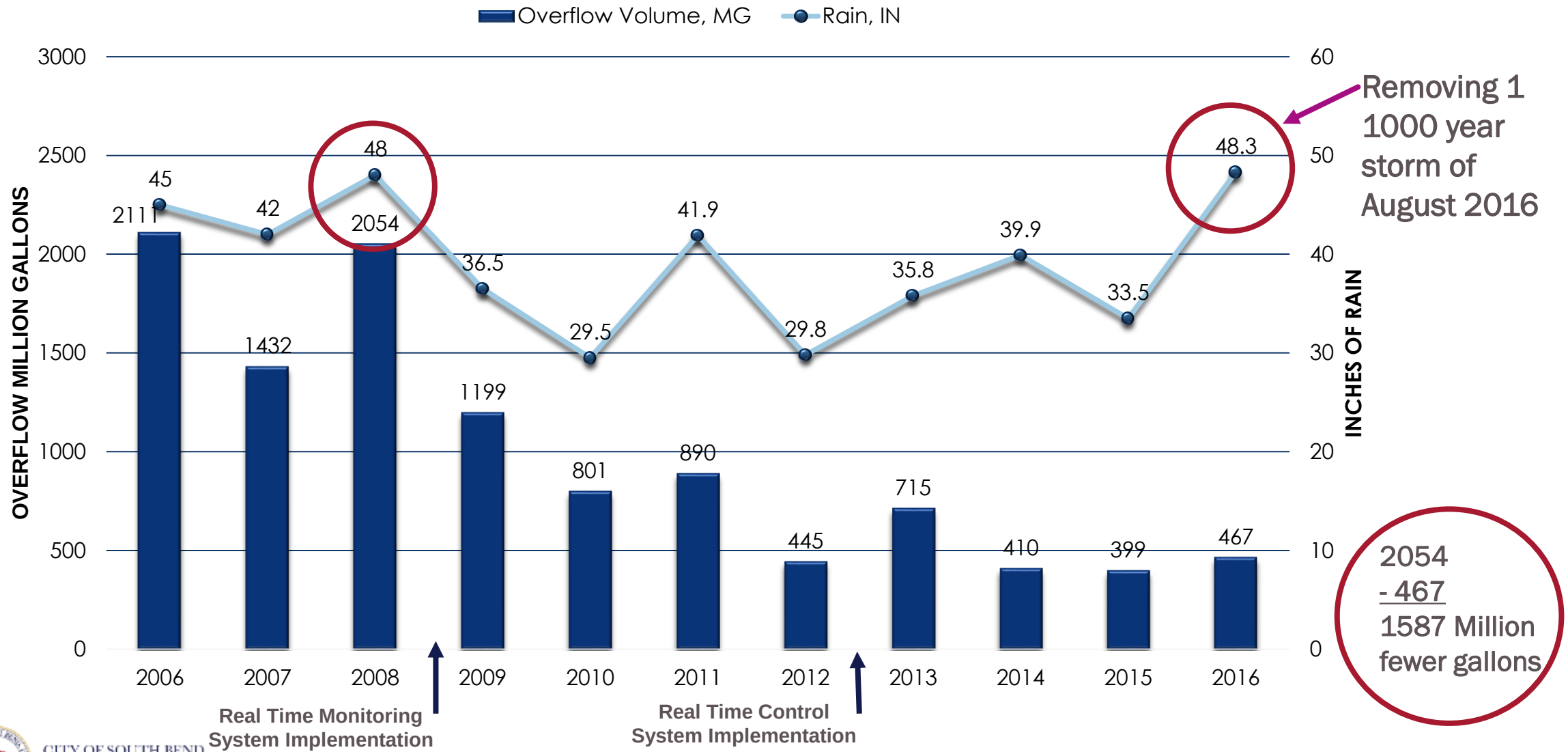
#3 Operate the Sewershed

- Default valve position is closed
- Measure likelihood of overflow
- Measure Interceptor capacity
  - Downstream
  - At “time of impact”
- Compete for Interceptor Capacity
- Modulate Valve

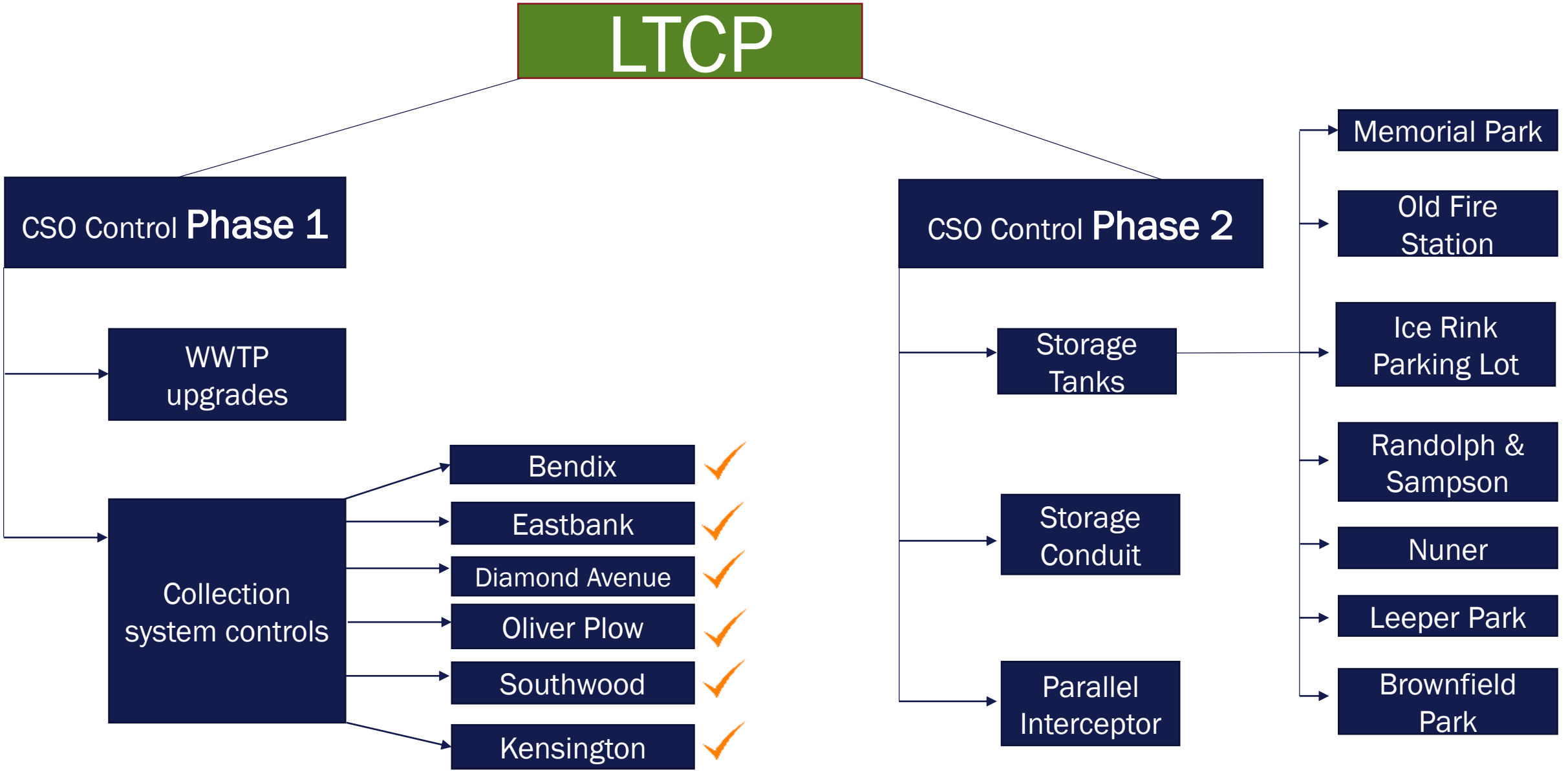
Phase 1 successes: How did we do?



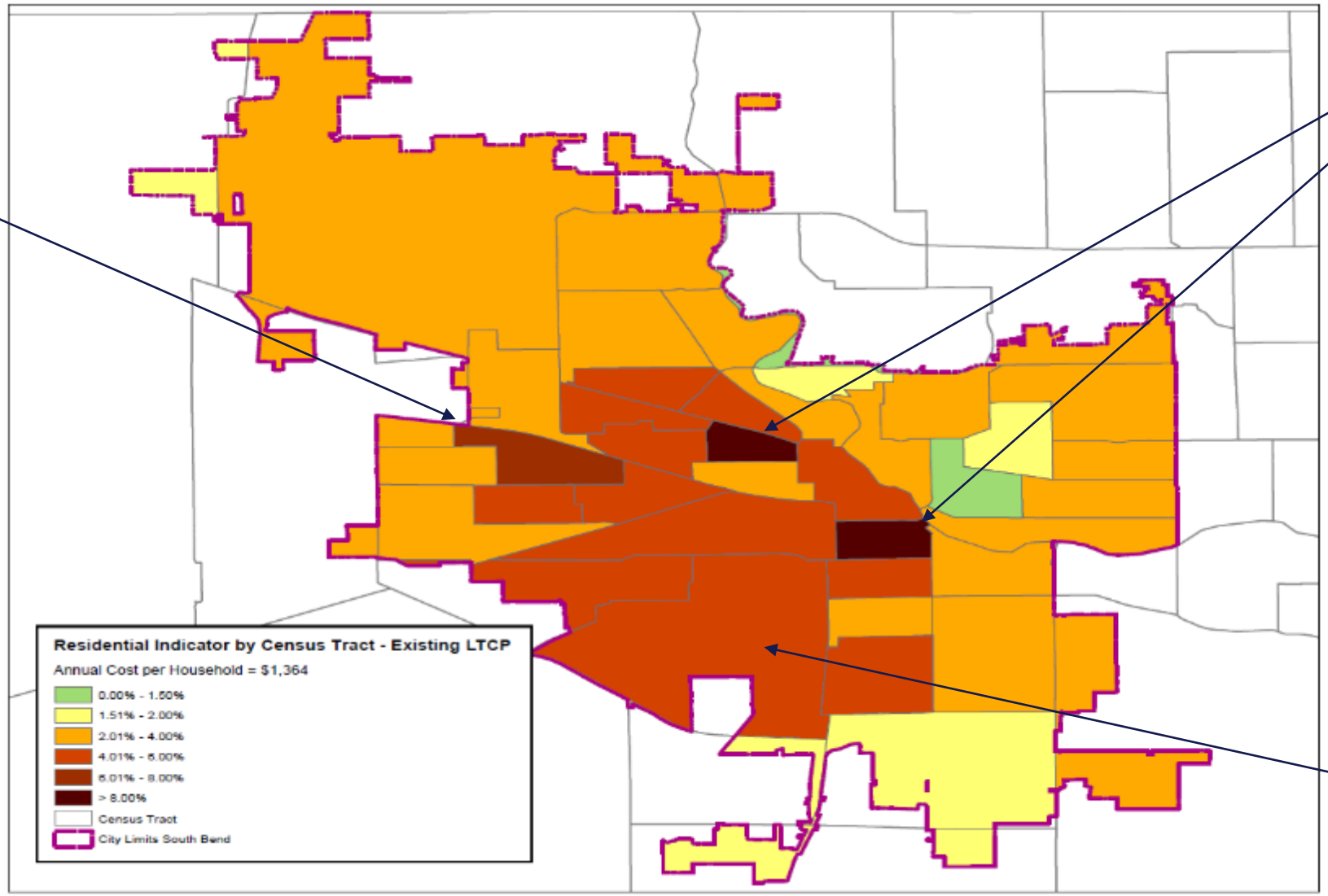
Phase 1 successes: How did we do?



CITY OF SOUTH BEND
PUBLIC WORKS


LTCP
CSO Control Phase 1
WWTP upgrades
Collection system controls
Bendix
Eastbank
Diamond Avenue
Oliver Plow
Southwood
Kensington
CSO Control Phase 2
Storage Tanks
Storage Conduit
Parallel Interceptor
Memorial Park
Old Fire Station
Ice Rink Parking Lot
Randolph & Sampson
Nuner
Leeper Park
Brownfield Park

Residential Indicator across South Bend

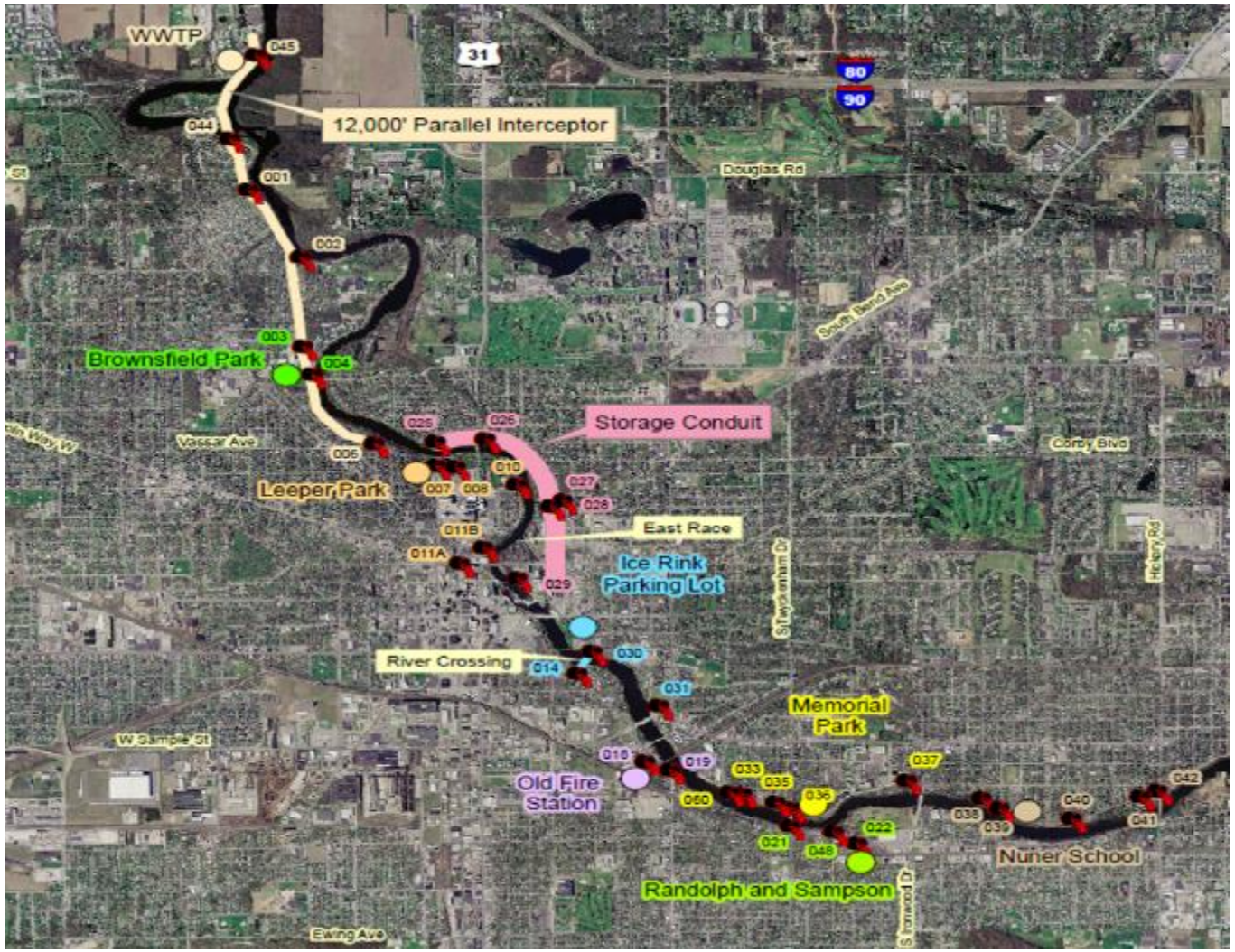


RI 6-8%

RI > 8%

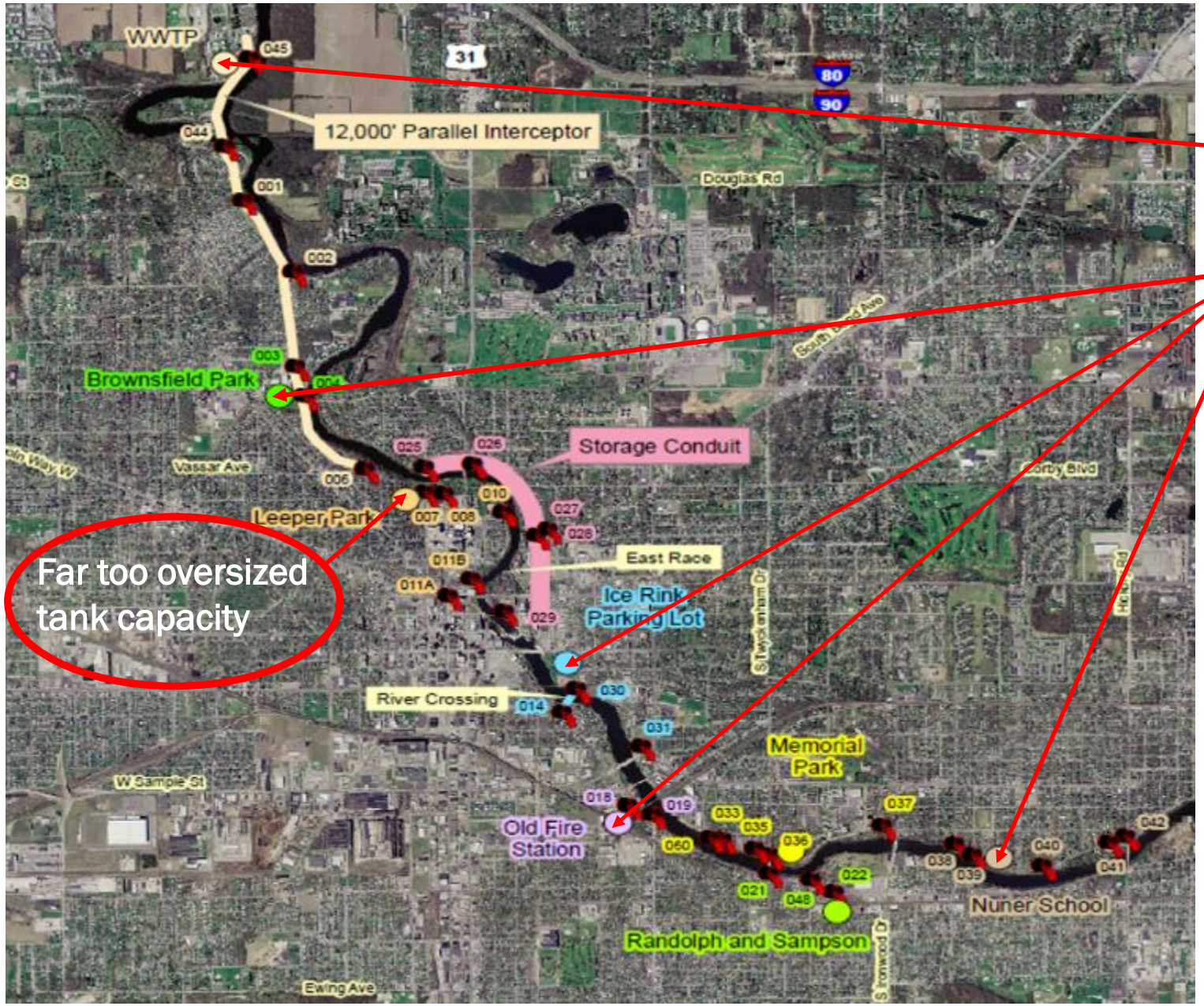
RI 4-6%

LTCP Phase 2



Phase 2 is an exclusively grey infrastructure approach. Unfortunately no smart or green technology.

- 7 Storage tanks
- 1 Storage conduit
- 1 Parallel interceptor



The many issues with current LTCP Phase 2:

WWTP: Expansion challenges
WWTP: No tank, yet largest CSO

4 small tanks: GSI, Smart sewers, Conveyance sewers can eliminate

Storage Conduit: Constructability concerns for available space, increased depth.

Parallel Interceptor: Would need to be deeper than existing, construction challenges due to river bank impact, river infiltration.

Revising the LTCP

1. Data-driven maintenance created increased capacity;
2. New hyper-accurate model shows deficiencies in old LTCP model;
3. Real Time Control exceeded expectations in reducing overflows;
4. Original LTCP builds infrastructure but does not address the problem.

Novel South Bend Proposal:

Use smart sewer data and new model to optimize the LTCP in the cloud!

Revising the LTCP: OptiSWMM

- Load Smart Sewer data and model in cloud
- Let OptiSWMM run every possible combination
- 100,000s of simulation runs
- Objective: find the most cost effective way of reducing overflows

STORMWATER MANAGEMENT: A SCIENTIST'S PERSPECTIVE

Stephen B. Weisberg, Ph.D.
Southern California Coastal Water Research Project Authority

September 12, 2018

Background

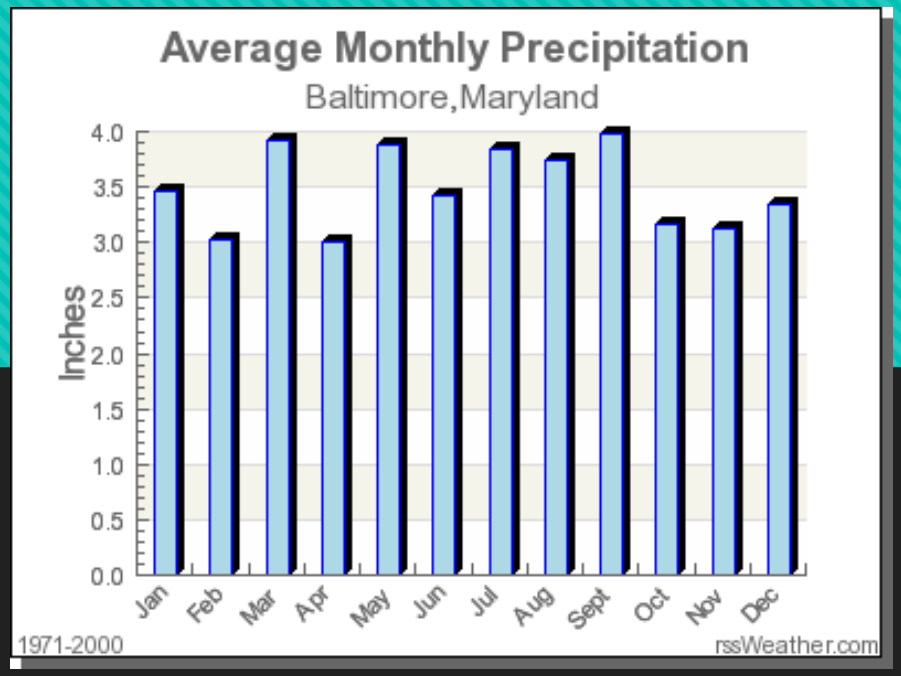
- Stormwater management is a daunting task with multiple goals
  - Stream habitat quality
  - Flood control
  - Water supply
- There are many management (potentially conflicting) options to select from
- Those options are often expensive
- There is a lot of uncertainty regarding success of those investments

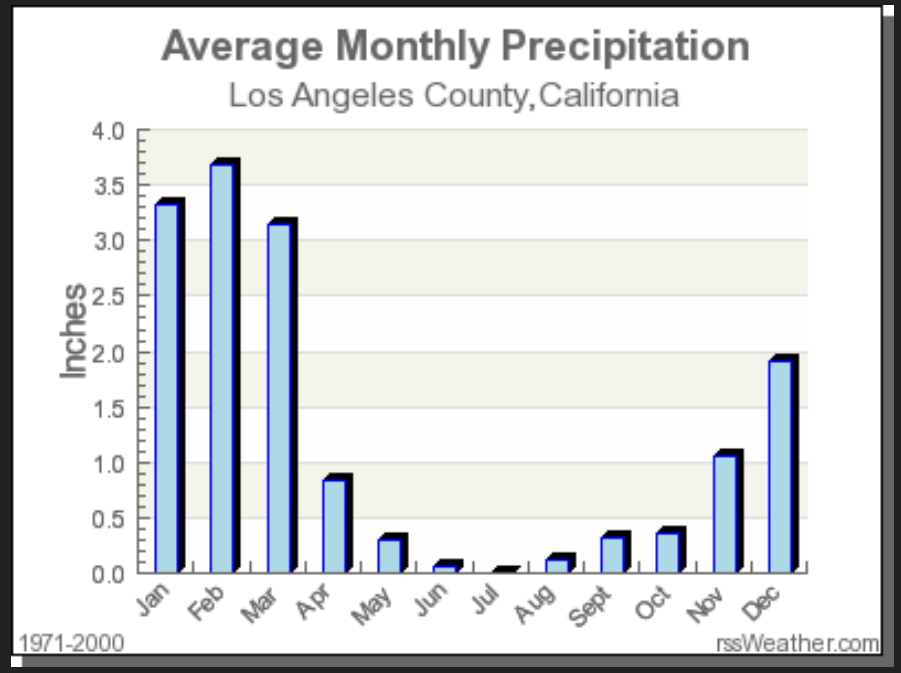
What are scientists doing to support you?

- Setting the stage through understanding landscape factors that define your management options
- Helping with option selection
- Providing ongoing information to support implementation
- Monitoring to help assess success

Flow is a driver

- California has a Mediterranean climate
  - Almost no rain for six months in a row
- Greater need for water storage
  - Must capture winter flows for use in the summer
  - Increased emphasis on recapture and reuse
- Changes the instream flow requirements
  - Too much withdrawal or infiltration leads to dry stream beds



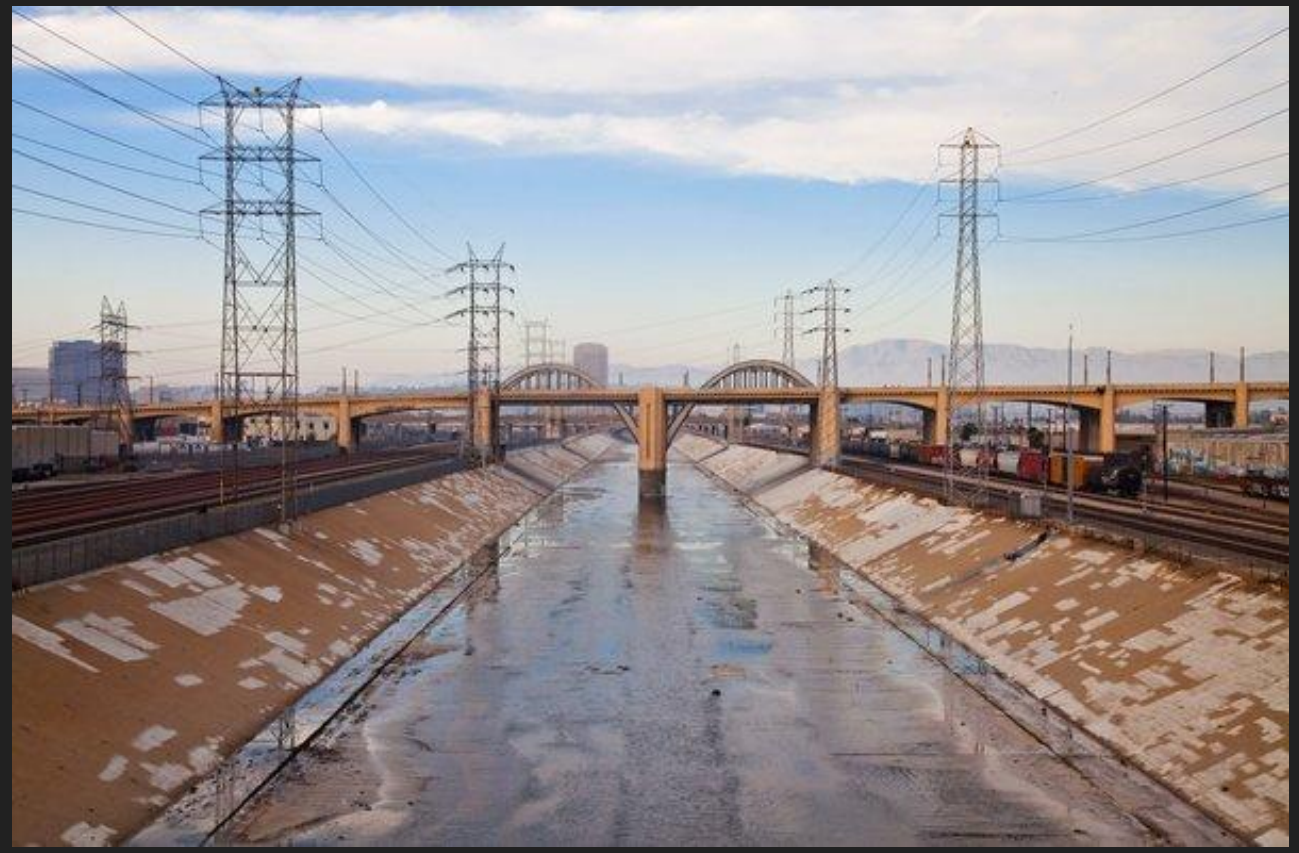


Watershed characteristics

- Amount of landscape development is key to management
  - High imperviousness leads to a rapid rise in flow after rain, with a rapid return to low flow
- Causes streambed scouring and habitat alteration
  - Also shifts the mission from habitat quality maintenance to flood control
- Scientists are working to define imperviousness management targets
  - Targets vary with watershed shape, steepness and rainfall
  - Know those targets because it is a lot easier to prevent a problem than it is to retrofit solutions

Separate stormwater and wastewater systems

- High impervious surface limits downstream treatment options
  - System demand becomes moving water off land quickly which overwhelms treatment plants
- Absence of downstream treatment enhances pollution concerns
- Means that treatment must take place in the watershed



Management toolbox

- BMPs are key to improved water quality
  - Many engineering advances ongoing
  - Water infiltrates faster
  - More chemical contamination is adsorbed
- Must be combined with modeling to predict effectiveness
  - BMP investments will cost billions
  - Modeling predicts cumulative effectiveness before installation
  - Modeling also provides guidance on the most effective locations for deployment

Real-time management support information

- Stormwater managers must make many real time decisions
  - How to manage dams or other control structures
  - When to close beaches because the management systems are overwhelmed
  - When storms are big enough to threaten public safety
- Scientists are developing many tools to provide that information support
  - Flow models
  - Remote sensing
  - Telemetered sensor networks

Real-time sensors

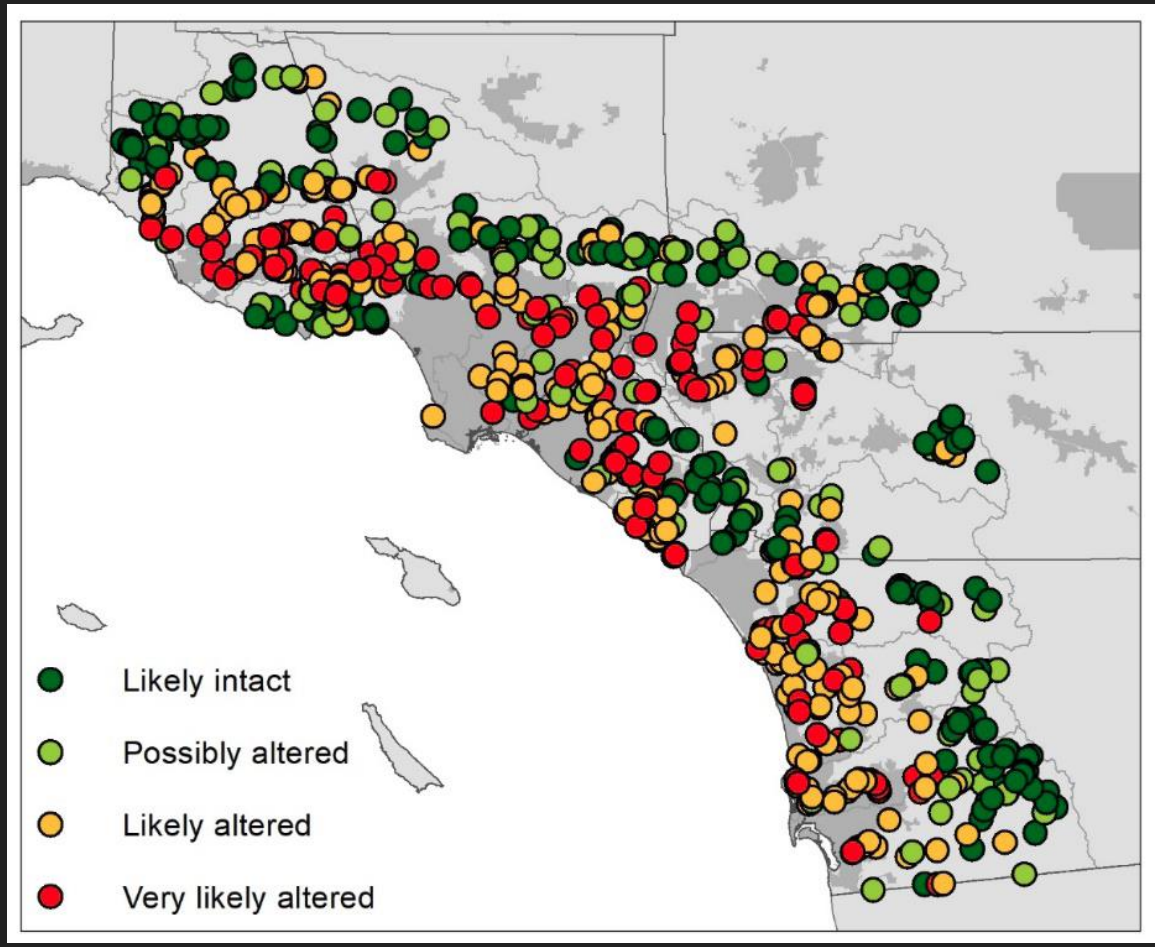
- Scientists are developing sensor networks that provide real-time information
  - Water flow, temperature, salinity
- We are also making big advances in genomics
  - Allow us to provide near-real time biological information
  - Initial applications have been for beach water quality
- We are now extending those advances to other biological applications
  - Harmful algal blooms
  - Invasive species

Results in 18-96 hours

Results in 2 hours

Monitoring to assess program effectiveness

- Continued investment should be guided by understanding of effectiveness
- Scientists are helping managers develop integrated regional monitoring programs
  - You want to know cumulative response, not just local effects
- These programs are increasingly focused on biological assessment endpoints
  - Biological communities are the integrator
  - Challenge for scientists is to identify biological expectations



Climate change as a wild card

- Changing rainfall patterns will alter stream management needs
  - Earlier snowmelt leads to more seasonality of flow
  - More intense storms will challenge runoff control capacity
- Enhanced fire frequency changes runoff characteristics
  - More sediment release
  - More contaminants
- The burden is on scientists to provide long-range predictions that will inform your management planning
  - We accept that burden

NATIONAL GOVERNORS ASSOCIATION

Managing Drought in a Changing Climate

Ellen Hanak, Director, Water Policy Center, Public Policy Institute of California

Elizabeth Ossowski, NOAA/National Integrated Drought Information System (NIDIS)

Moderator: Joaquin Esquivel, Board Member, California State Water Resources Control Board

Managing Drought in a Changing Climate

Four Essential Reforms

September 10, 2018

Ellen Hanak

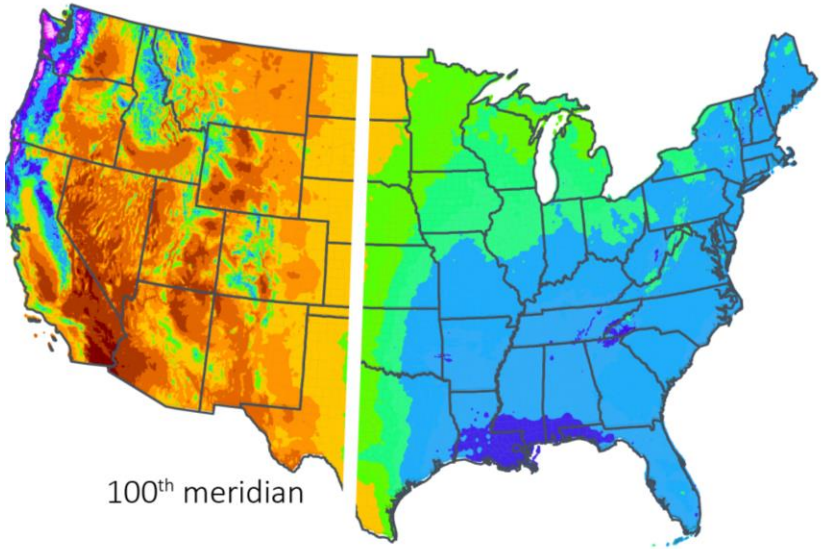
Research supported by the S. D. Bechtel, Jr. Foundation and the US Environmental Protection Agency

PPIC PUBLIC POLICY INSTITUTE OF CALIFORNIA

PPIC WATER POLICY CENTER

Western states are drier, with more variable precipitation

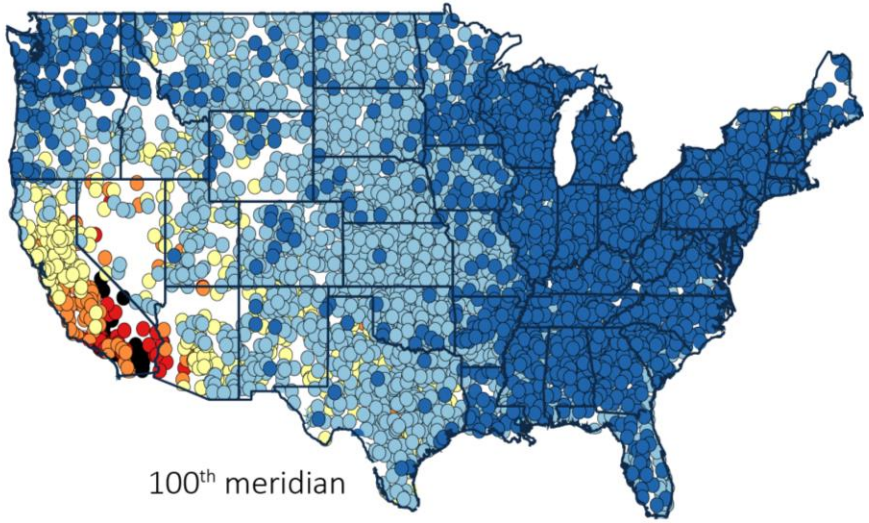
Average Annual Precipitation (1981-2010)



Annual Precipitation (inches)

< 4	24-32	100-120
4- 8	32-40	120-140
8-12	40-60	140-160
12-16	60-80	> 160
16-24	80-100	

Rainfall Variability



Rainfall Variability

least variable — *most variable*

0.1 0.2 0.3 0.4 0.5 0.6 0.7

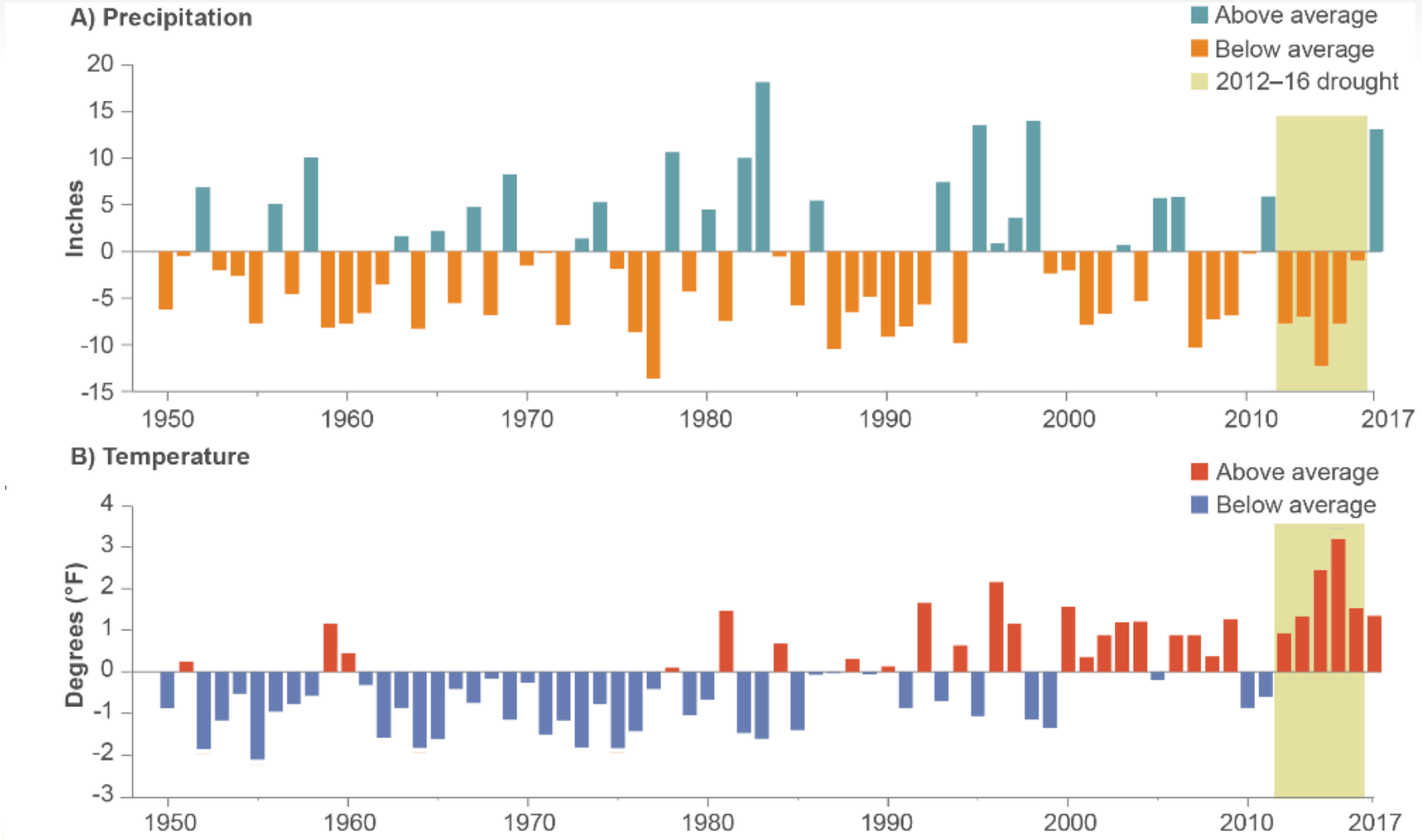
Left map source: Oregon State University (2015)

Right map source: Dettinger (2011)

Managing water is at the forefront of climate change adaptation in California

- Drought reveals strengths and weaknesses in water systems
- Actions to prepare for droughts of the future will benefit water management today

The unusually warm drought of 2012–16 was a window into the future



Five climate pressures are impacting California's water system

Warming temperatures


Shrinking snowpack


Shorter wet seasons


More volatile precipitation


Rising seas

Reducing vulnerability to climate pressures requires concerted action

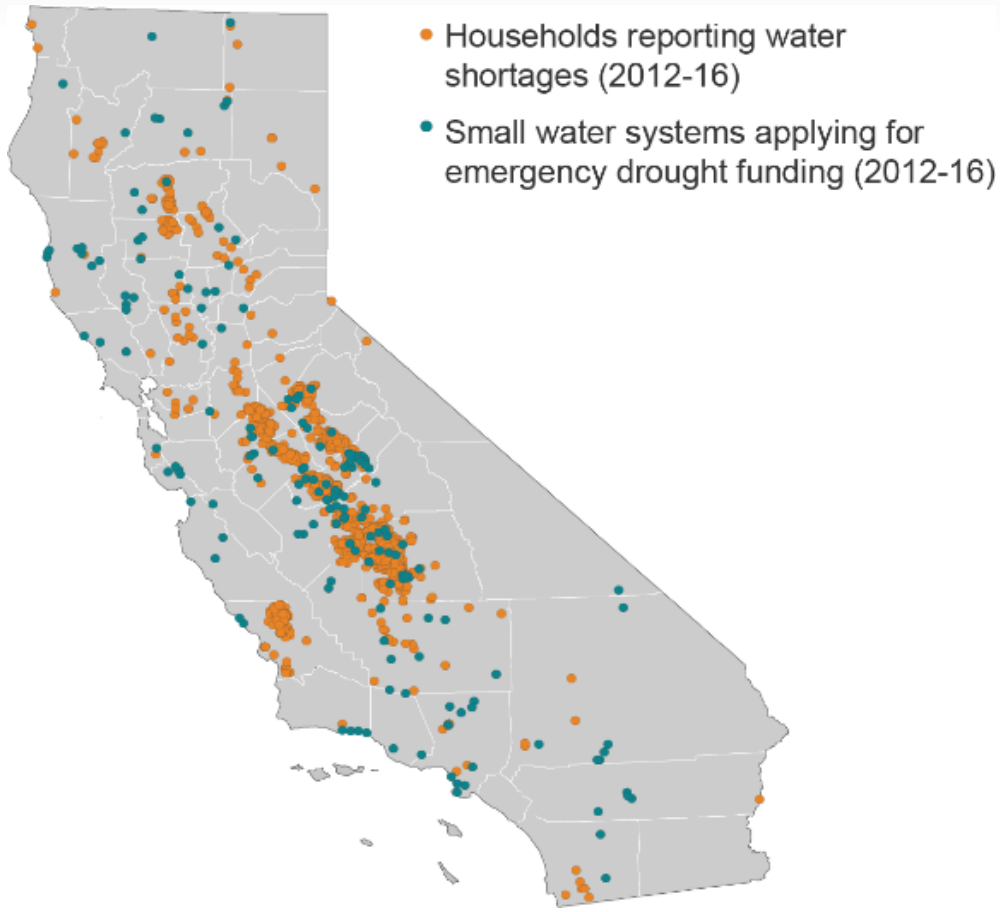
Four essential reforms:

1. Plan ahead
2. Upgrade the water grid
3. Update water allocation rules
4. Find the money

Shasta Reservoir during drought

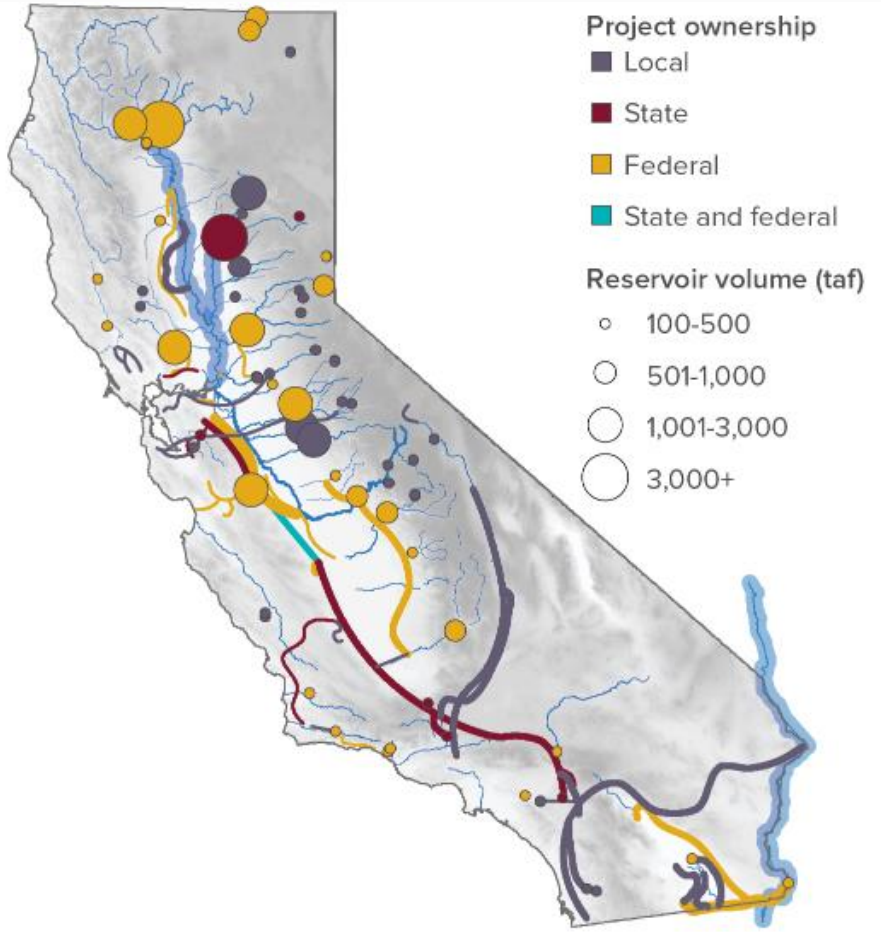
Reform 1: Plan ahead

- Successful adaptation requires advance planning at local and regional scales.
- Top priorities:
  - Strengthen urban water management plans
  - Ensure effective groundwater sustainability plans
  - Develop drinking water plans for rural communities
  - Prepare ecosystem drought plans



Reform 2: Upgrade the water grid

- Modernizing California's "water grid" can help reduce costs of future droughts
- Top priorities:
  - Improve conveyance and storage capacity
  - Modernize and integrate operations



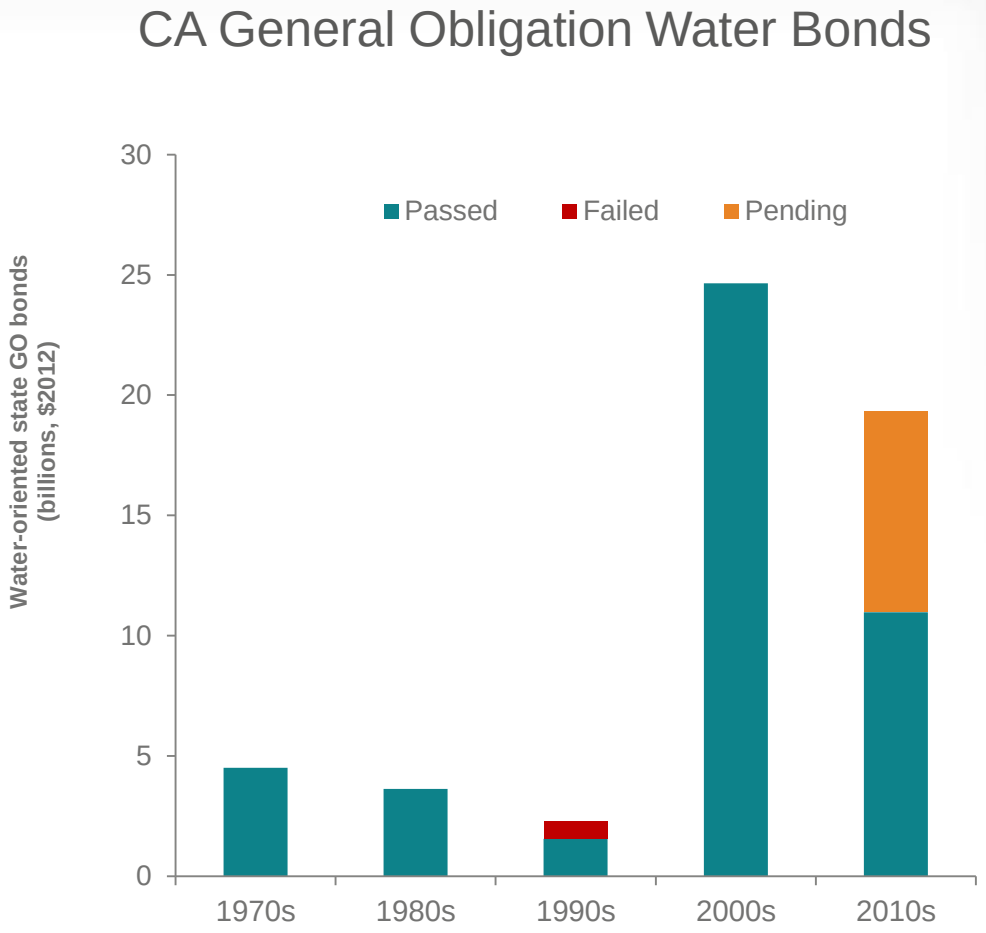
Reform 3: Update water allocation rules

- Facilitate equitable and efficient allocation during dry times, promote capture and storage during wet times
- Top priorities:
  - Promote groundwater recharge
  - Streamline trading and banking
  - Give the environment a water budget
  - Improve water rights administration

Sacramento National Wildlife Refuge

Reform 4: Find the money

- Reliable sources of funding are crucial for adapting to climate change
- Top priorities:
  - Use general obligation bonds for public benefit
  - Fill the gap for fiscal orphans
  - Reform water pricing law



Reasons for optimism

- Urban sector has been adapting and investing
- Agriculture has been innovating, improving efficiency, and working toward groundwater sustainability
- Progress is under way on safe drinking water supplies in rural communities

The environment needs a fundamental change in course

- Efforts to date haven't stopped species decline
- Climate pressures increasing the risk
- More flexible, ecosystem-based management is needed

Lower Yuba River

Getting ready for droughts of the future will require strong leadership

Managing Drought in a Changing Climate

Four Essential Reforms

September 10, 2018

Ellen Hanak

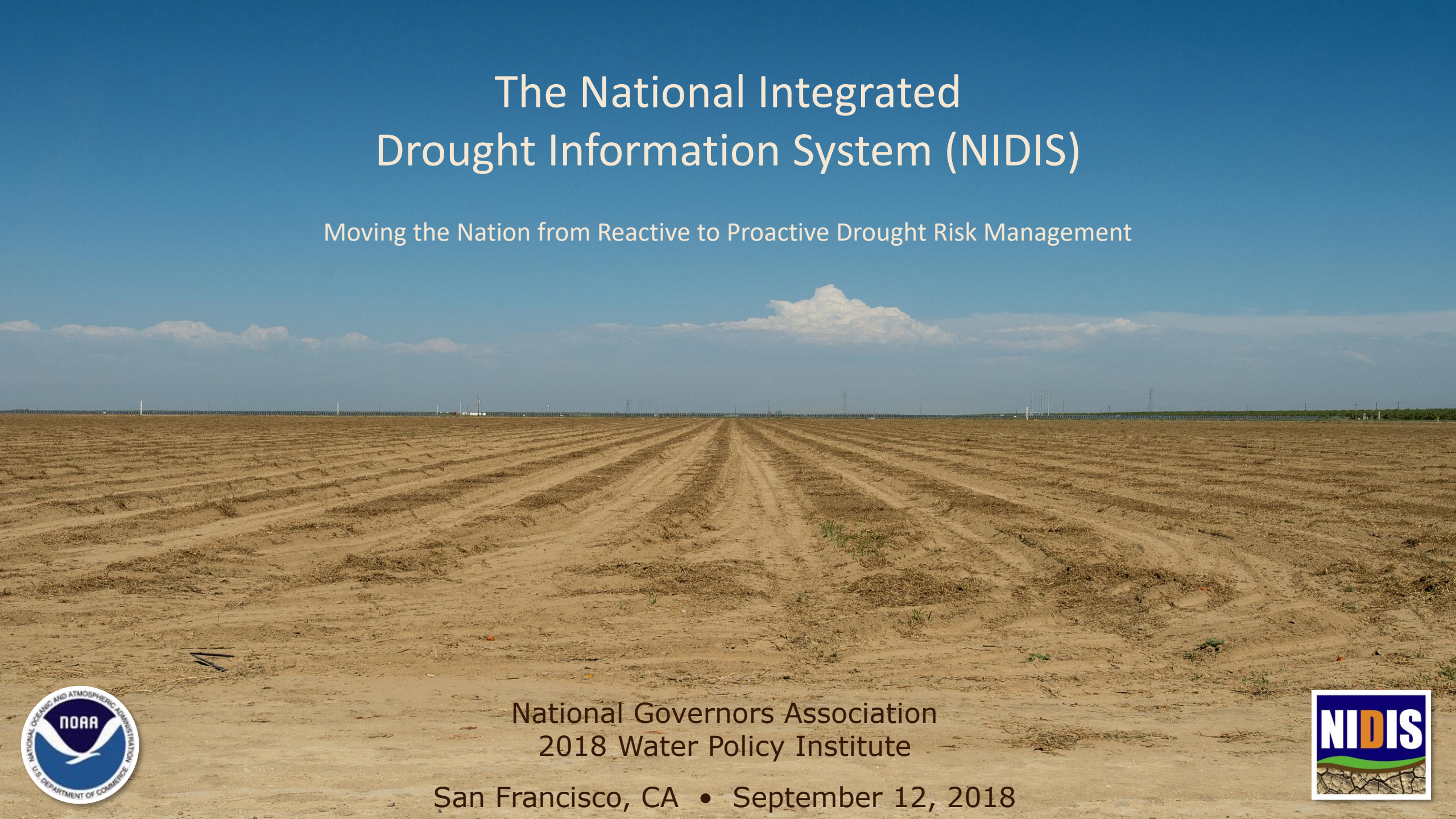
Research supported by the S. D. Bechtel, Jr. Foundation and the US Environmental Protection Agency

PPIC PUBLIC POLICY INSTITUTE OF CALIFORNIA

PPIC WATER POLICY CENTER

The National Integrated Drought Information System (NIDIS)

Moving the Nation from Reactive to Proactive Drought Risk Management



National Governors Association
2018 Water Policy Institute

San Francisco, CA • September 12, 2018

What is NIDIS?

NIDIS was authorized by Congress in 2006 and reauthorized in 2014 with an interagency mandate to develop and provide a national drought early warning information system.

How NIDIS Came About

1996:
Western Governors Association (WGA) advocates for change in how the U.S. prepares for and responds to drought.

1998:
National Drought Policy Act establishes an advisory commission on integrated, coordinated Federal drought policy.

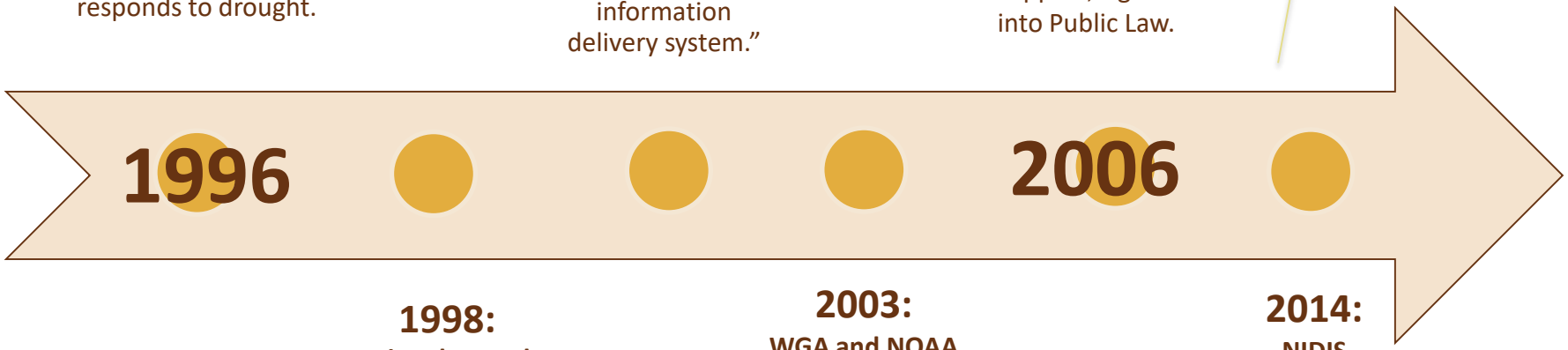
2000:
National Drought Policy Commission Report: Develop "an effective drought information delivery system."

2003:
WGA and NOAA produce "Creating a Drought Early Warning System for the 21st Century."

2006:
NIDIS authorized by Congress with bipartisan support, signed into Public Law.

2012: **81%** of the U.S. was at least abnormally dry, **$30B** in damages

2014:
NIDIS reauthorized by Congress with bipartisan support through FY18, signed into law.

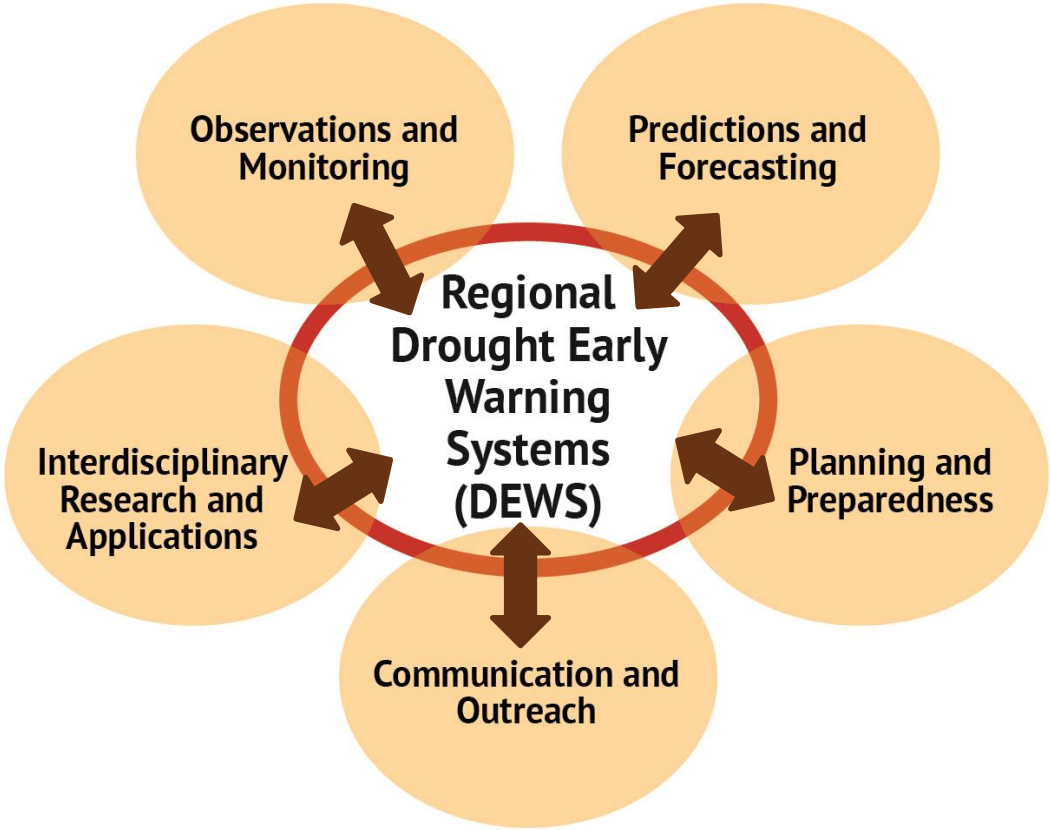


What is a Drought Early Warning System?

"A system that collects and integrates information on the key indicators of drought in order to make usable, reliable, and timely drought forecasts and assessments of drought…..

…and communicates drought forecasts, conditions, and impacts on an ongoing basis to decision makers, the private sector, and the public."

- NIDIS Public Law 109-430

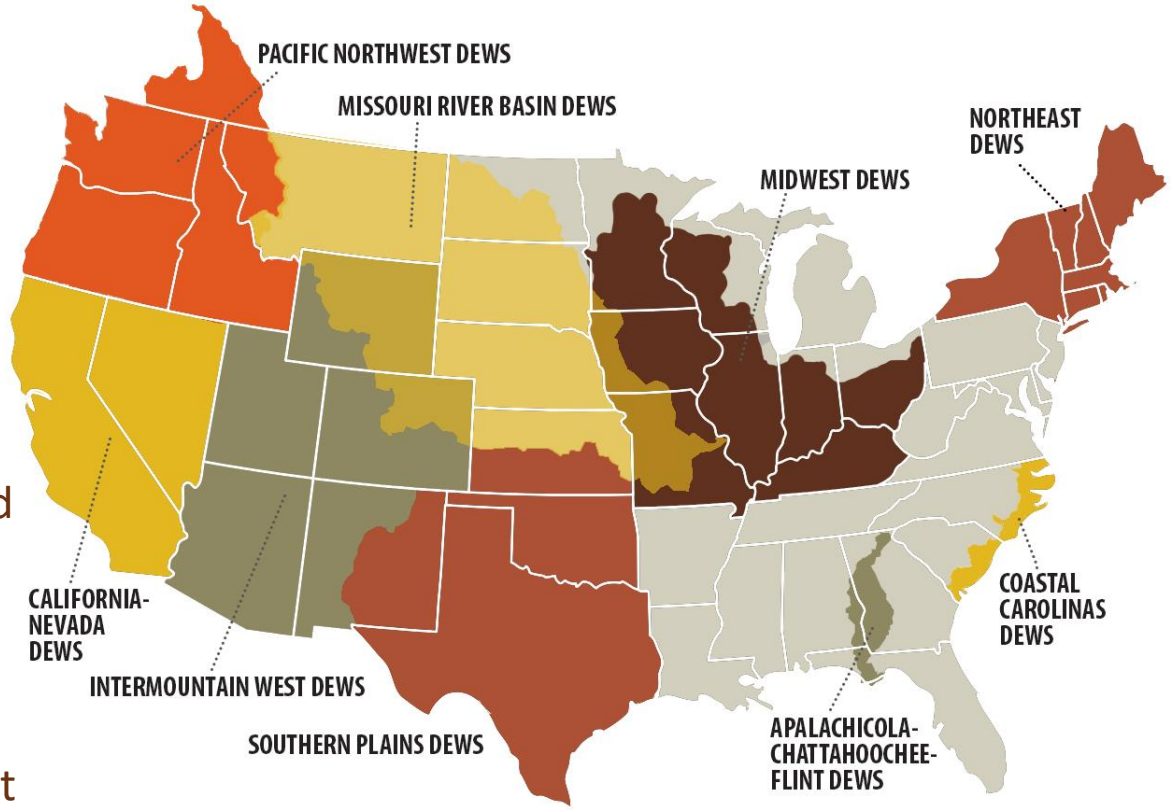


9 Regional Drought Early Warning Systems

Britt Parker

Amanda Sheffield

Elizabeth Weight



Molly Woloszyn

Elizabeth Ossowski

Veva Deheza

Components of a Drought Early Warning System

Observations & Monitoring

- U.S. Drought Monitor
- Drought Impact Reporting
- Drought Assessments and Attribution Studies
- Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS)

Predictions & Forecasting

- Improve monthly, sub-seasonal, seasonal drought outlooks
- Atmospheric Rivers – model predictability and document knowledge gaps
- Flash Droughts – how do they come about? How do they link to past drought events?

Components of a Drought Early Warning System

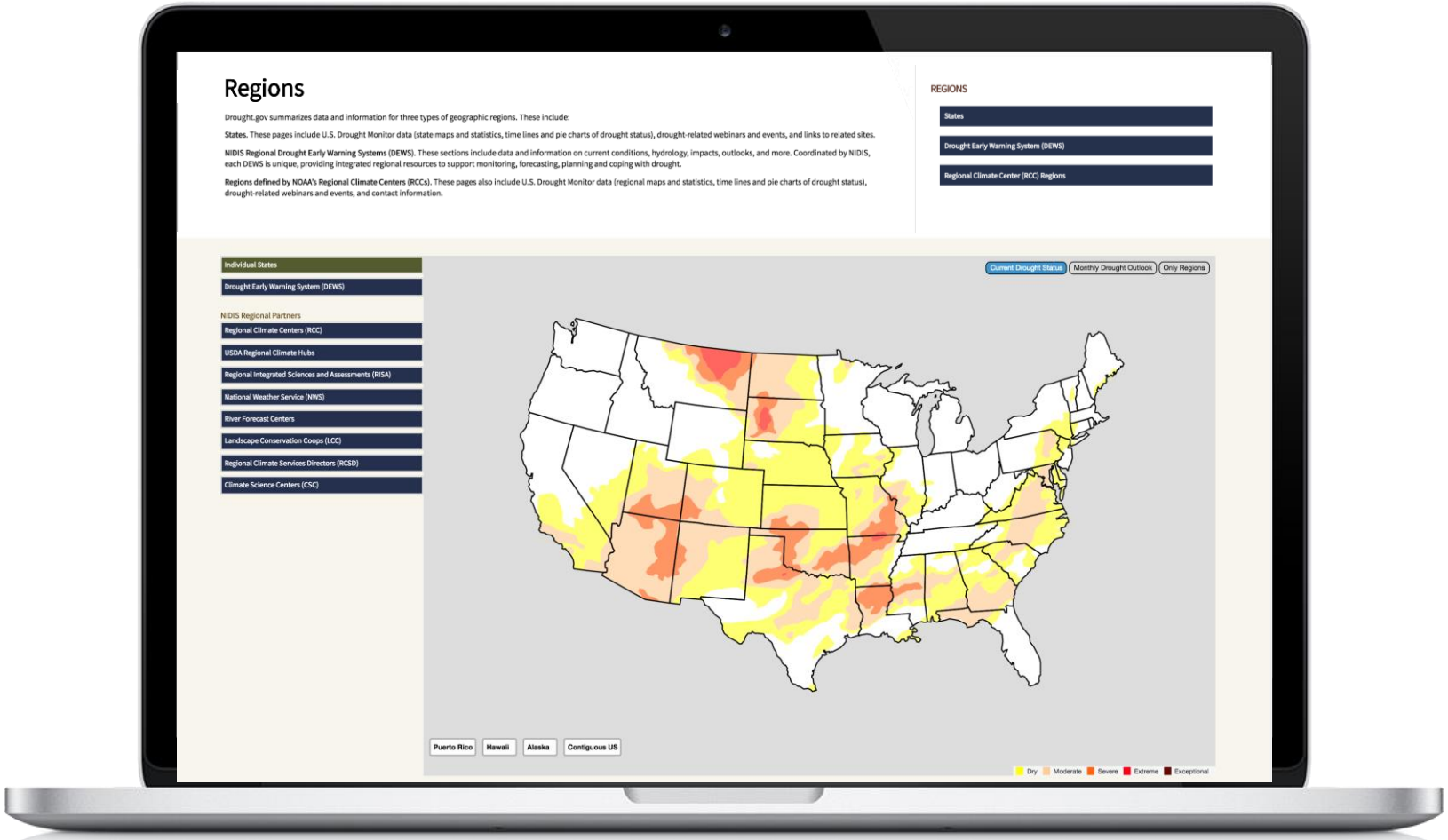
Planning & Preparedness

- Drought Triggers and Indicators Research, Workshops
- NDMC Drought Plan Mapping Database
- CDC Every Drop Counts (Drought and Public Health)
- Partner with USBR Drought Response Program

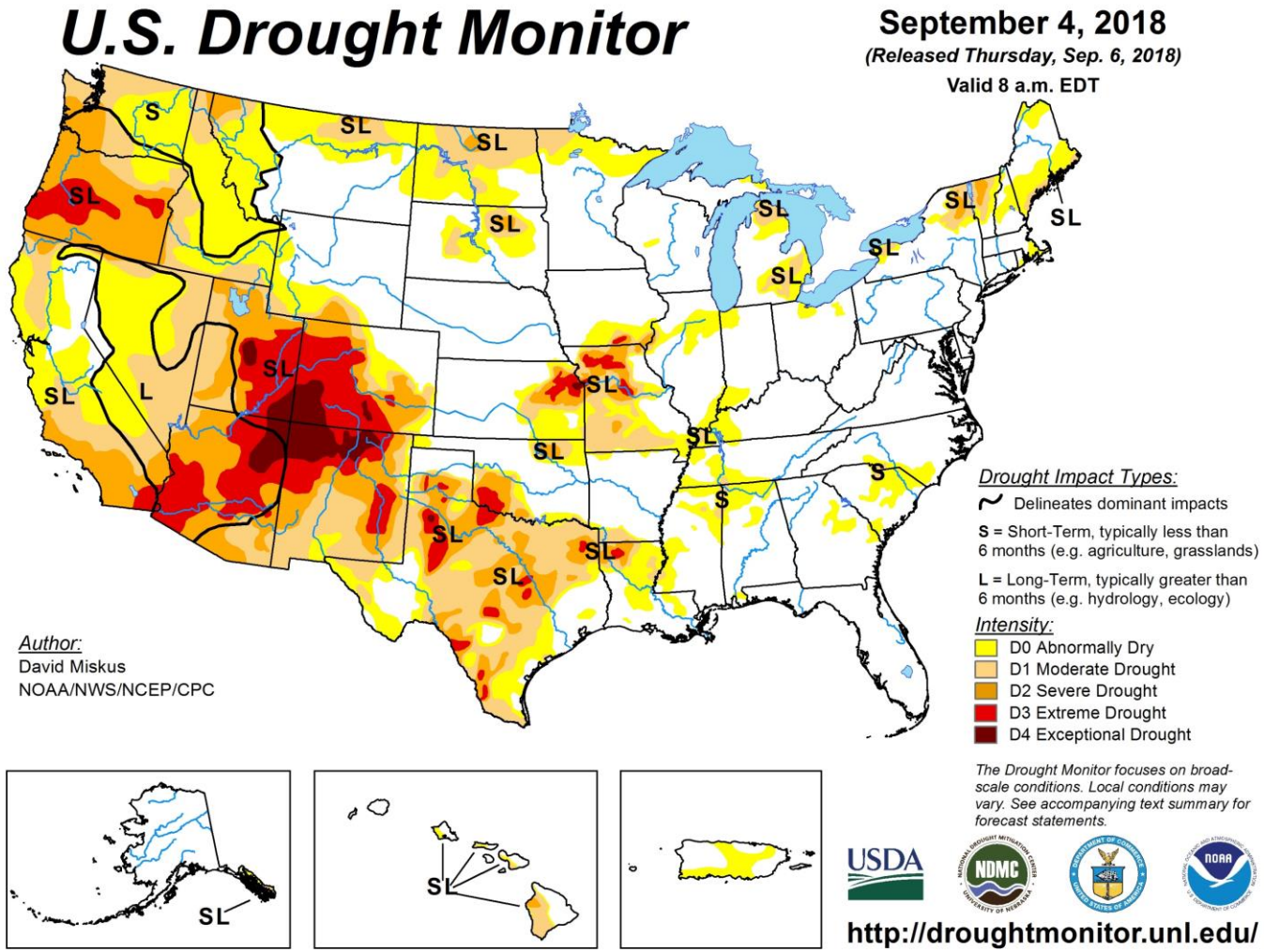
Communication & Outreach

- Midwest Drought Communications Working Group
- National Drought and Wildfire Network (NDAWN)
- Drought Tournaments, Guidebook
- USBR Forecast Rodeo

U.S. Drought Portal
www.drought.gov



U.S. Drought Monitor



Snow Drought

- Snow drought is a period of abnormally low snowpack for the time of year, reflecting either
  - below-normal cold-season precipitation (dry snow drought) or
  - lack of snow accumulation despite near-normal precipitation (warm snow drought), caused by warm temperatures and precipitation falling as rain rather than snow or unusually early snowmelt.
- Current Conditions
- Snow Drought Impacts
- Tools and Resources

https://www.drought.gov/drought/data-maps-tools/snow-drought

Current Drought Response

Drought Status Update

National Integrated Drought Information System
Drought.gov

PACIFIC NORTHWEST

JULY 31, 2018

Little Camas Fire, near Cashmere, WA (US Forest Service)

Significant Drought and Related Fire Impacts Reported in Idaho, Oregon, and Washington

- A combination of high temperatures, low humidity, and dry to record-dry conditions has increased fire danger.
- Wildfires continue to threaten lives, property, crops, rangeland, and forests (Fig. 1).
- Drier-than-normal conditions are expected to continue across most of the region, which will perpetuate fire danger.

CURRENT CONDITIONS

- OR and WA have been experiencing dry weather. Combined with high temperatures, this led to the designation of moderate drought in the Olympic Peninsula, abnormal dryness in parts of eastern WA, and the introduction of severe drought across the Cascades and into the Willamette Valley last week. Southern ID and the panhandle are abnormally dry with some areas of moderate drought (Fig. 2).
- According to the Northwest River Forecast Center, monthly precipitation through July 30, 2018, is below 50% of normal. Over the last 90 days, precipitation totals for parts of western OR and WA were the lowest they've been in at least 40 years (Fig. 3).
- In southern and southwest OR, the drought, with recent warm and dry conditions, has caused dead fuel moisture to decline to record-low levels, increasing the potential flammability of fuels.

IMPACTS

- In ID, there are nine large, uncontained wildfire incidents currently burning over 173,000 acres including the Grassy Ridge fire (103,935 acres, 88% contained).
- In OR, there are 14 large, uncontained wildfire incidents currently burning over 116,500 acres including Taylor Creek fire (25,000 acres, 20% contained).
- In WA, there are six large, uncontained wildfire incidents currently burning over 15,500 acres including the Lake Wallula fire (10,500 acres, 55% contained).
- Approximately 10,140 firefighters and support personnel are deployed in OR, WA and ID, taxing resources and personnel in the region.
- All three states are reporting negative impacts to forests, crops and rangelands, reduced air quality, and multiple evacuations.

Fig 1. InciWeb - Incident Information System for Pacific Northwest Region for July 31, 2018. Source: (inciweb.nwcg.gov

U.S. Drought Monitor
USDA Northwest Climate Hub

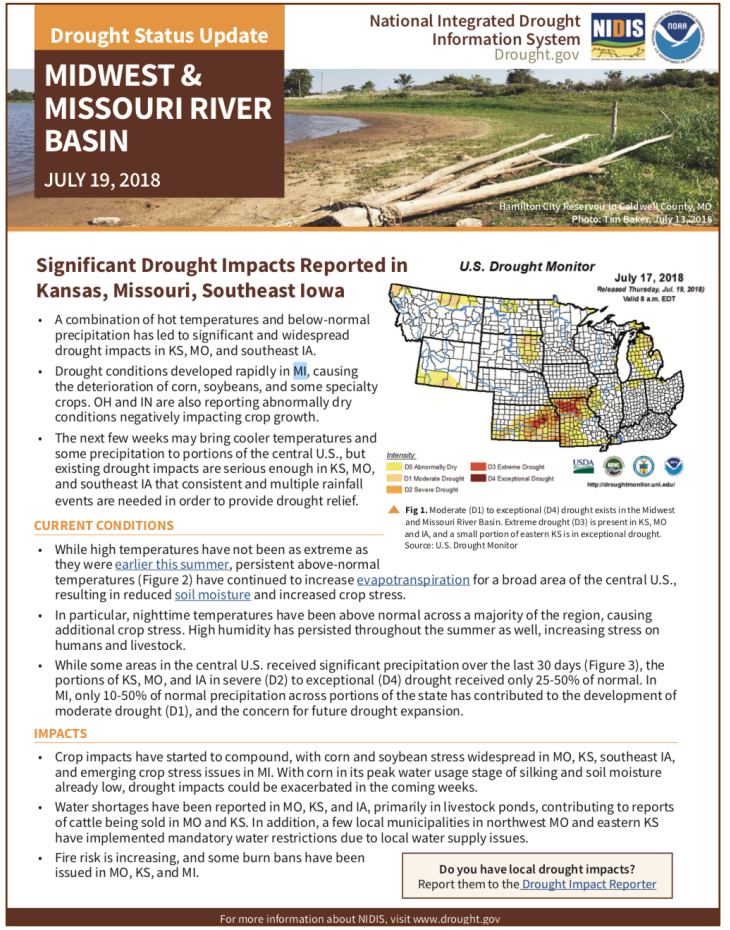
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

http://droughtmonitor.unl.edu/

Fig 2. US Drought Monitor for the Northwest for July 26, 2018. Source: U.S. Drought Monitor (http://droughtmonitor.unl.edu)

Do you have local drought impacts?
Report impacts to the Pacific Northwest Drought Impact Reporter to help inform decisions and drought response!

For more information about NIDIS, visit www.drought.gov



Drought Status Update

National Integrated Drought Information System
Drought.gov

MIDWEST & MISSOURI RIVER BASIN

JULY 19, 2018

Hamilton City Reservoir in Caldwell County, MO
Photo: Tim Baker, July 13, 2018

Significant Drought Impacts Reported in Kansas, Missouri, Southeast Iowa

U.S. Drought Monitor
July 17, 2018
Released Thursday, Jul. 19, 2018
Valid 8 a.m. EDT

- A combination of hot temperatures and below-normal precipitation has led to significant and widespread drought impacts in KS, MO, and southeast IA.
- Drought conditions developed rapidly in MI, causing the deterioration of corn, soybeans, and some specialty crops. OH and IN are also reporting abnormally dry conditions negatively impacting crop growth.
- The next few weeks may bring cooler temperatures and some precipitation to portions of the central U.S., but existing drought impacts are serious enough in KS, MO, and southeast IA that consistent and multiple rainfall events are needed in order to provide drought relief.

Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

http://droughtmonitor.unl.edu/

Fig 1. Moderate (D1) to exceptional (D4) drought exists in the Midwest and Missouri River Basin. Extreme drought (D3) is present in KS, MO and IA, and a small portion of eastern KS is in exceptional drought. Source: U.S. Drought Monitor

CURRENT CONDITIONS

- While high temperatures have not been as extreme as they were earlier this summer, persistent above-normal temperatures (Figure 2) have continued to increase evapotranspiration for a broad area of the central U.S., resulting in reduced soil moisture and increased crop stress.
- In particular, nighttime temperatures have been above normal across a majority of the region, causing additional crop stress. High humidity has persisted throughout the summer as well, increasing stress on humans and livestock.
- While some areas in the central U.S. received significant precipitation over the last 30 days (Figure 3), the portions of KS, MO, and IA in severe (D2) to exceptional (D4) drought received only 25-50% of normal. In MI, only 10-50% of normal precipitation across portions of the state has contributed to the development of moderate drought (D1), and the concern for future drought expansion.

IMPACTS

- Crop impacts have started to compound, with corn and soybean stress widespread in MO, KS, southeast IA, and emerging crop stress issues in MI. With corn in its peak water usage stage of silking and soil moisture already low, drought impacts could be exacerbated in the coming weeks.
- Water shortages have been reported in MO, KS, and IA, primarily in livestock ponds, contributing to reports of cattle being sold in MO and KS. In addition, a few local municipalities in northwest MO and eastern KS have implemented mandatory water restrictions due to local water supply issues.
- Fire risk is increasing, and some burn bans have been issued in MO, KS, and MI.

Do you have local drought impacts?
Report them to the Drought Impact Reporter

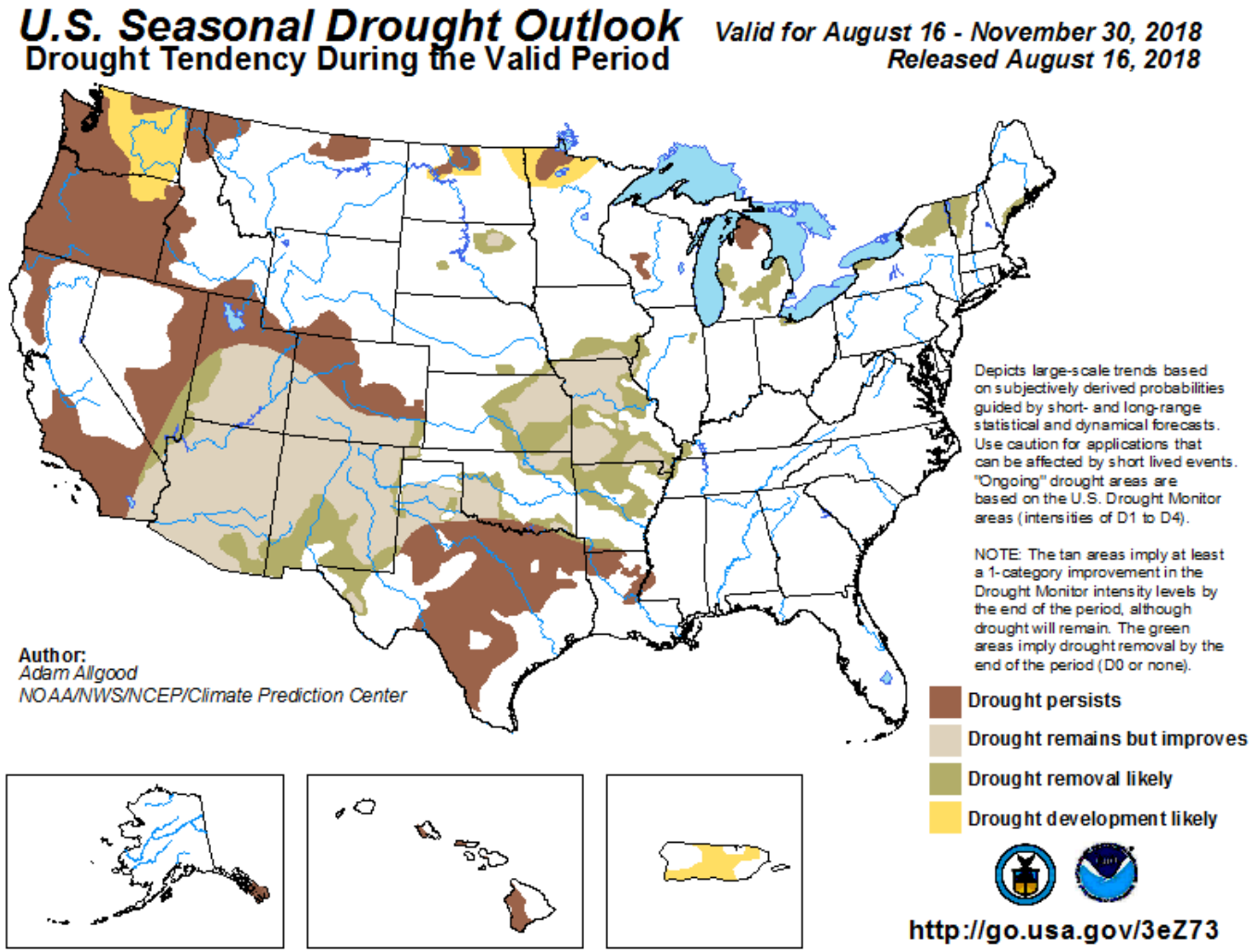
For more information about NIDIS, visit www.drought.gov

https://www.drought.gov/drought/calendar

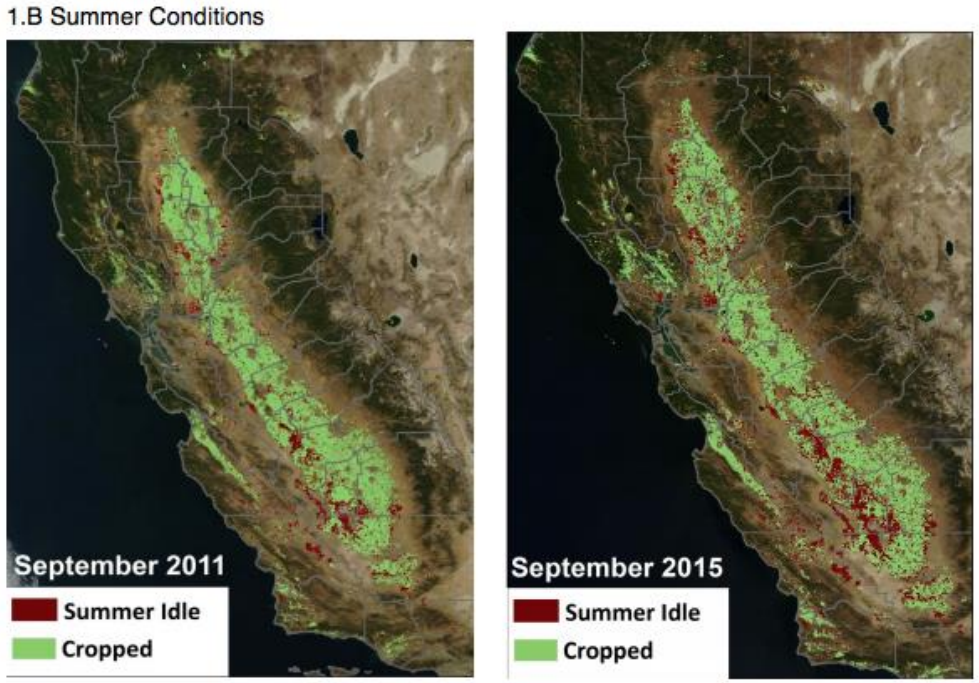
PNW DEWS Meeting (10/9, Boise ID)
CA-NV DEWS Workshop (Jan or Feb 2019)

CA-NV Drought, Climate Outlook Webinar (9/24 at 11am PT)
Southern Plains Drought Webinar (10/22 at 1pm CT)

Seasonal Drought Outlook (8/16 – 11/30)



Fallowed Land Tracking



Fallowed Area Mapping for Drought Impact Reporting:

2015 Assessment of Conditions in the California Central Valley

October 14, 2015

Forrest Melton, Carolyn Rosevelt, Alberto Guzman, Lee Johnson, Isabel Zaragoza
NASA Ames Research Center Cooperative for Research in Earth Science Technology and Education & CSU Monterey Bay

James Verdin (PI), Prasad Thenkabail, Cynthia Wallace
USGS

Rick Mueller, Patrick Willis
USDA National Agricultural Statistics Service

Jeanine Jones
California Department of Water Resources

Support provided by the NASA Applied Sciences Program and the NOAA National Integrated Drought Information System Program Office

- Monitoring extent of bare agricultural lands assisted CA in deciding water project allocations and state drought water bank operations
- Currently expanding to Nevada and the Pacific Northwest

Climate Engine

- **ClimateEngine.org** is a free web application powered by Google Earth Engine to monitor weather and vegetation using on-demand cloud processing of remote sensing and gridded climate datasets
- **Customized requests**: Datasets (Down to Variable), Calculations (ex. % of Avg), Time Periods, Custom Region



University of Idaho

DRI Desert Research Institute

Google

NIDIS

Landsat Program

NASA Earth Science Applied Sciences Program

U.S. Department of the Interior Bureau of Land Management

FEWS NET Famine Early Warning Systems Network

USGS science for a changing world

CIRC A NOAA RISA TEAM

Western Regional Climate Center Providing climate services since 1986

REACCH Regional Approaches to Climate Change – Pacific Northwest Agriculture

National Soil Moisture Monitoring Network

Develop:

- **National, multi-platform soil moisture gridded product** from existing soil moisture data sources across federal and state in-situ monitoring networks, satellite remove sensing missions, and numerical modeling capabilities
- **Consistent methodology** for data collection and installation of in-situ probes including metadata standards

in support of decision-making for water supply and infrastructure, agriculture, fire risk management, and ecosystem health

State Drought Planning

Drought Plan

Colorado Drought Mitigation and Response Plan: Drought Annex to the State All Hazards Mitigation Plan, Annex VII to the State Emergency Operations Plan

Released in 2013
Colorado Water Conservation Board

Climate Plan

Colorado Climate Preparedness Project Final Report

Released in 2011
Wester Water Assessment

General Hazard Plan

Colorado Natural Hazards Mitigation Plan

Released in 2013
State of Colorado

Water Plan

Colorado Water Plan

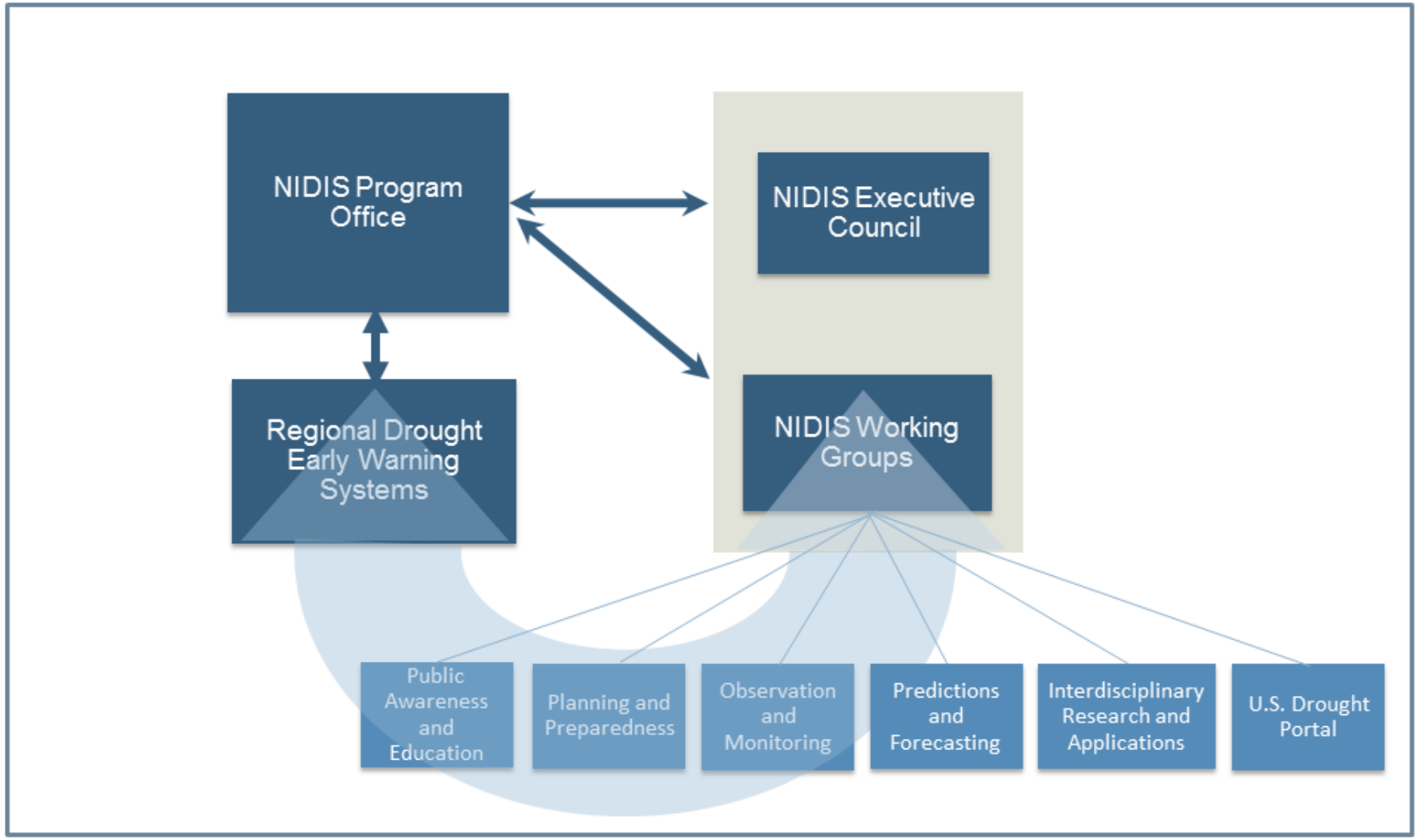
Released in 2015
Colorado Water Conservation Board

- Drought.unl.edu/droughtplanning
- Select “Info By State”

Plan Criteria

☐ **Drought Defined**	Does the plan define or describe drought, or how its effects threaten human, natural, or physical assets within the state?
☐ **Drought Addressed**	Does the plan specifically address aspects of planning for drought or its impacts?
☐ **General Drought Preparedness**	Does the plan include enactable measures to generally be more prepared for drought? Ideally, these measures would be enacted in advance of a drought, and could involve establishing a drought task
☐ **Triggers for Action**	Are particular drought indicators connected to actions or measures outlined in the plan?

Conceptual Organizational Model for NIDIS



Thank You

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Elizabeth.ossowski@noaa.gov

@DroughtGov

@DroughtGov

National Integrated Drought Information System

(NIDIS) - NOAA Service Account

Breakout Sessions

Saving Dollar & Resources by Optimizing Water-Energy Policy

Anna Henderson, Water Policy Advisor, Office of Governor Mark Dayton

Christina Ashie Guidry, Policy Analyst & Title VI/Environmental Justice Coordinator, Office of Policy & Sustainable Practices, Tennessee Department of Environment & Conservation

Using the Water Infrastructure Financing Act (WIFIA) to Address Governors Major Water Infrastructure Challenges

Jordan Dorfman, Senior Attorney Advisor, WIFIA Program, EPA

Michael Carlin, Deputy General Manager & Chief Operating Officer, San Francisco Public Utilities Commission

NGA

NATIONAL GOVERNORS ASSOCIATION

Snapshot of Federal Legislation and Funding

Alex Schaefer,

Government Relations, Natural Resources Committee

National Governors Association

NATIONAL GOVERNORS ASSOCIATION

Closing Remarks