Drinking Water Utility Preparedness for Wildland-Urban Interface Fires

February 13, 2023

CORONA
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Time	Program	Speaker
8:00am	Check-in (coffee and light breakfast)	All
8:30am	Welcome and Introductions	Chad Seidel, Shonnie Cline
8:40am	Overview of Water Utility Response to Marshall Fire	Chad Seidel, Alex Ariniello, Kurt Kowar
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12:00pm	Lunch and Open Discussion	All

Water System Responses and Lessons Learned from the Marshall Fire

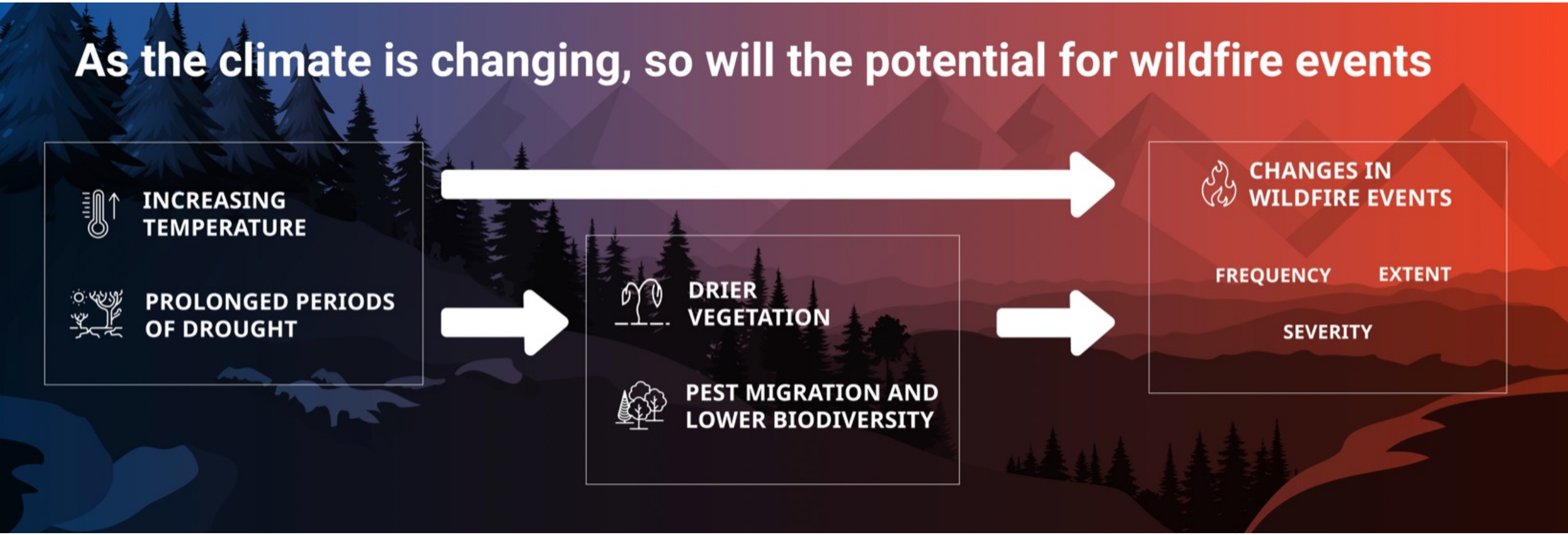
Chad Seidel, Ph.D., P.E., Alex Ariniello, P.E., Kurt Kowar, P.E.

February 13, 2023

So many acknowledgements!

- Boulder
- Longmont
- South Adams Water
- Thornton
- Arvada
- Westminster
- Denver Water
- Left Hand Water
- Lafayette
- Boulder County
- Purdue University
- Oregon State University
- University of Colorado Boulder
- Colorado State University
- CDPHE
- USEPA
- ALS Laboratory

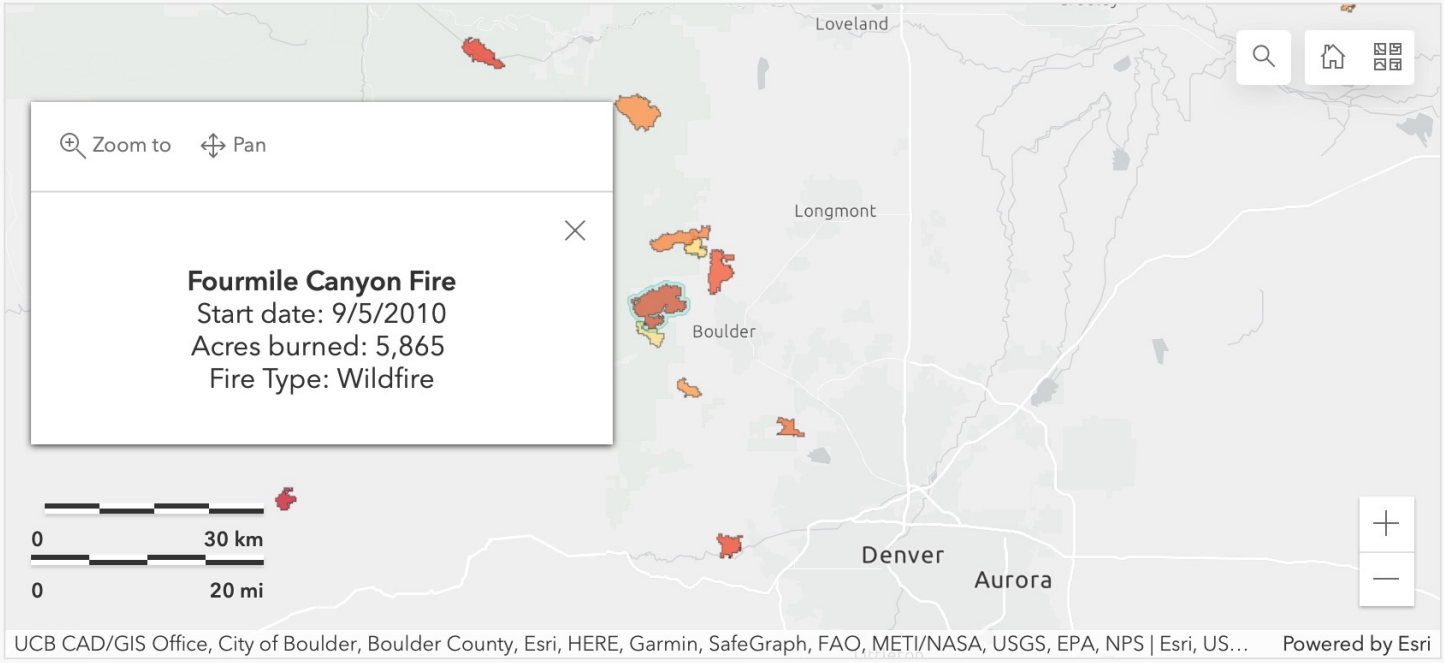
Wildfires are something to contend with…

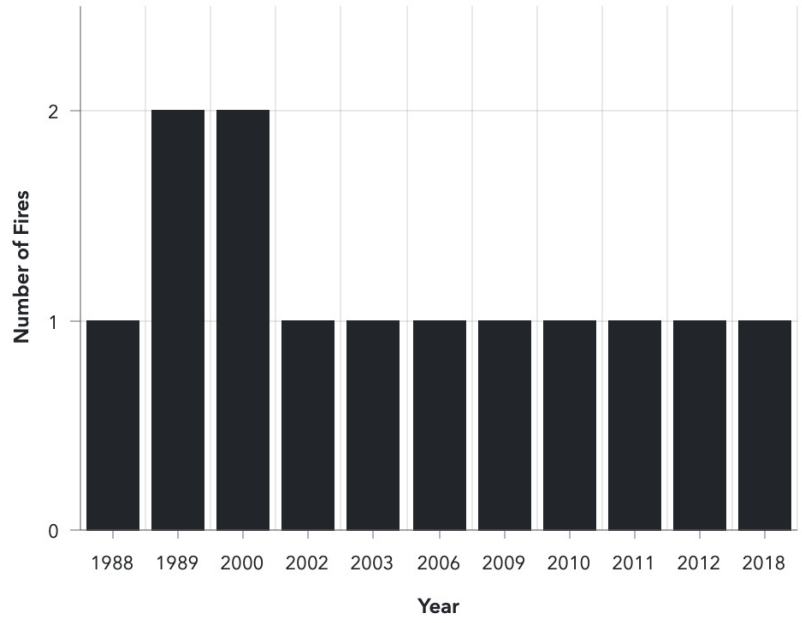


USEPA: https://storymaps.arcgis.com/stories/54123fb6d09b49a49b91cbe4d64fdf66

Wildfire Trend Explorer

This Data Explorer summarizes the time series of large fire events in the area shown in the map below. Zoom into your area of interest to see the extents of wildfire events from 1984 through 2019. Note that only the years with fires in the map view with be displayed in the graph. Darker-colored fire areas on the map indicate fires from more recent years. You can also select bars in the graph to view events in those specific years.





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Large fires (≥1,000 acres)

Data above is for fires larger than 1,000 acres, per the standards of the Monitoring Trends in Burn Severity (MTBS) program. Data from the MTBS program is updated once a year.

USEPA: https://storymaps.arcgis.com/stories/54123fb6d09b49a49b91cbe4d64fdf66

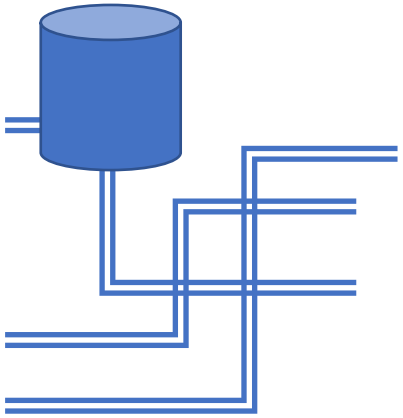
Top Ten Largest Fires in Colorado

Rank	Fire	Year	Acres Burned	Impacted Water Utilities
1	Cameron Peak	2020	208,913	Fort Collins, City of Greeley, others
2	East Troublesome	2020	193,812	Northern Water Conservancy District
3	Pine Gulch	2020	139,007	Ute Water Conservancy District
4	Hayman	2002	137,760	Denver Water, City of Aurora
5	Spring Creek	2018	108,045	La Veta, Walsenburg
6	High Park	2012	87,284	Fort Collins, City of Greeley, others
7	Missionary Ridge	2002	70,285	Town of Bayfield, City of Durango
8	West Fork	2013	58,570	Pagosa Area Water & Sanitation District
9	416	2018	54,129	City of Durango
10	Papoose	2013	49,628	N/A
*	Marshall	2021	6,026	City of Louisville, Town of Superior

Wildfire impacts on water utilities

Source Water

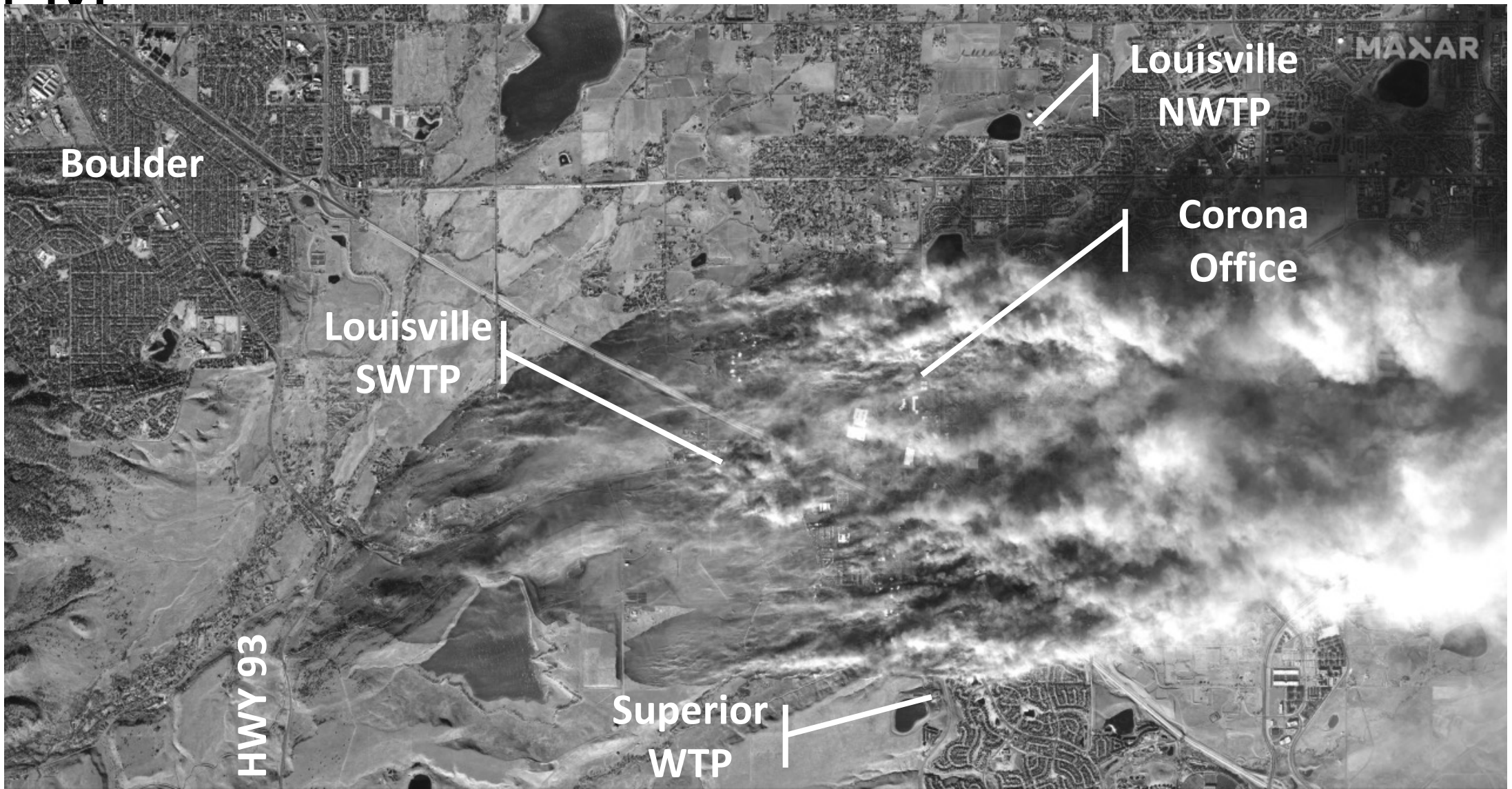
Water Treatment Plant

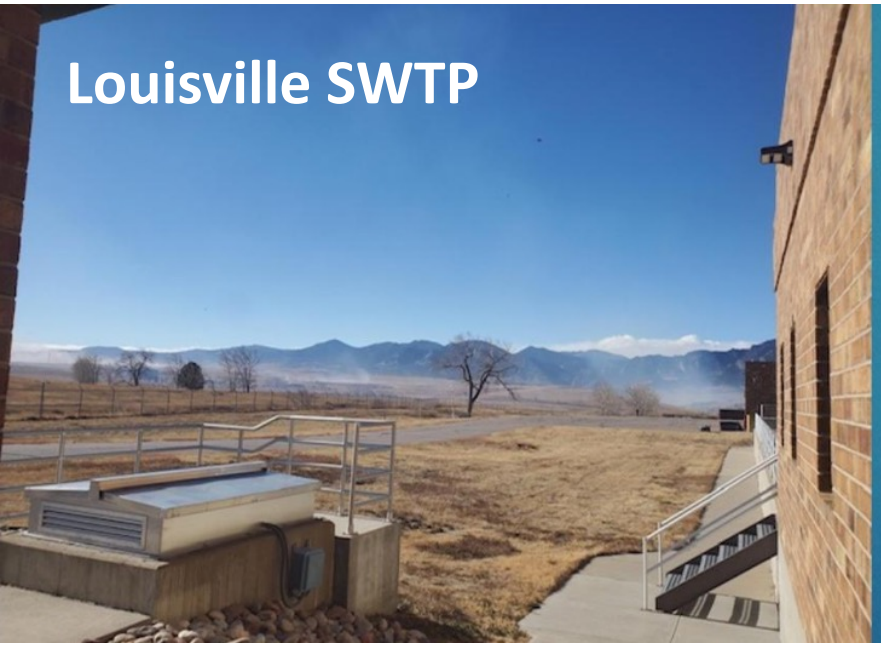


Distribution System

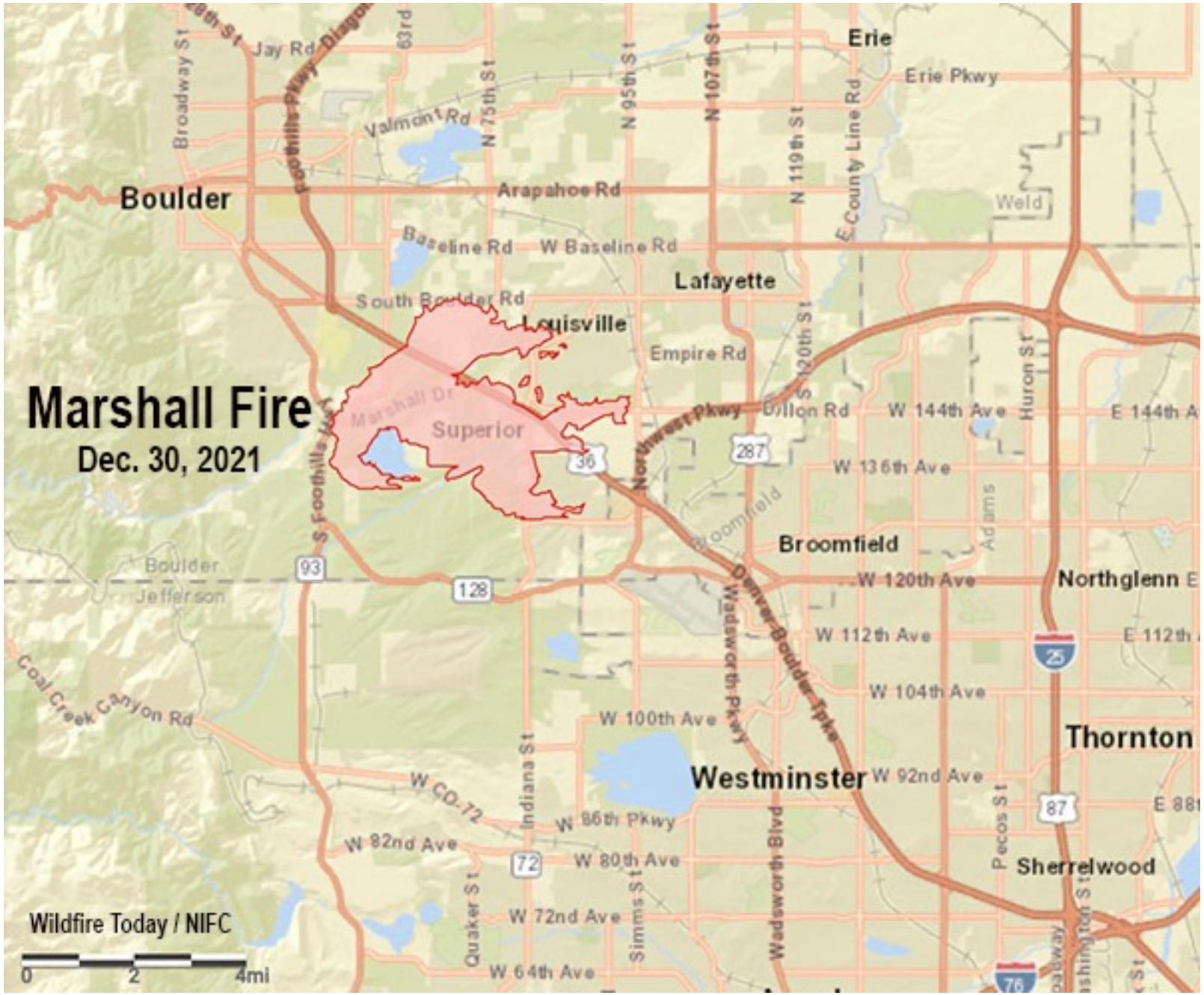
Buildings

Marshall Fire – December 30, 2021, 3:00 PM





Greg Venette, City of Louisville, Presentation to Colorado Water Utility Council, August 5, 2022

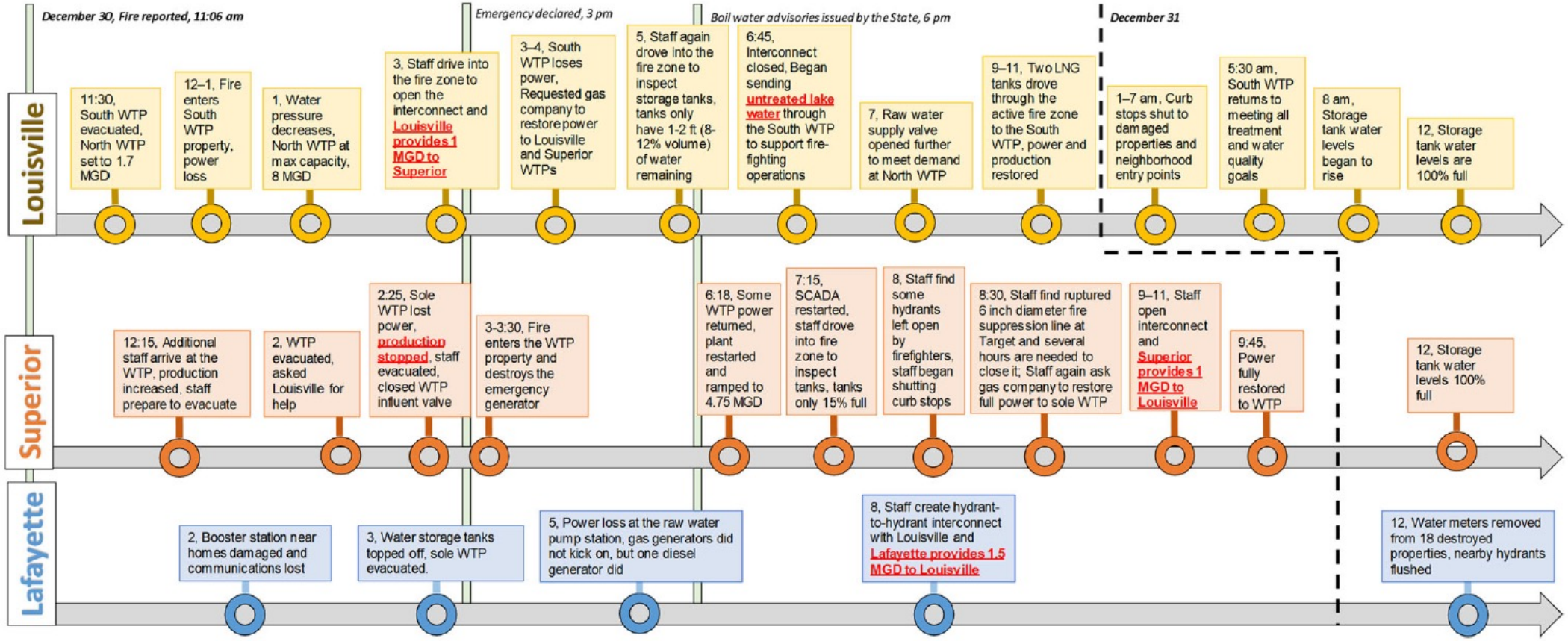


Map from Wildfire Today/NIFC

Damage	Louisville	Superior	Boulder County
Destroyed	553	332	106
Damaged	45	60	22

Marshall Fire, Superior, Colorado, by Chad Seidel

Timeline: December 30-31, 2021

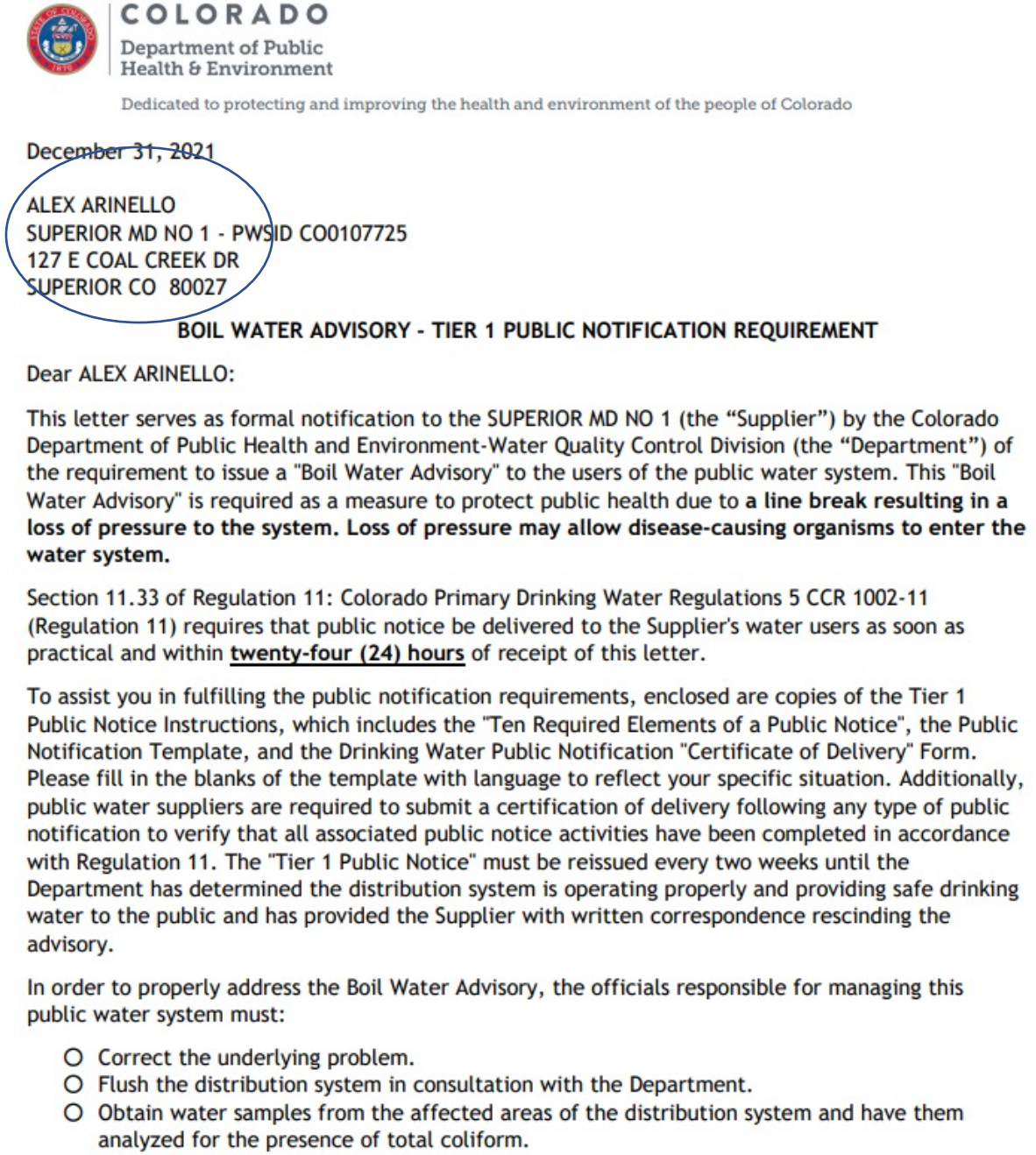


Andrew J. Whelton, Chad Seidel, Brad P. Wham, Erica C. Fischer, Kristofer Isaacson, Caroline Jankowski, Nathan MacArthur, Elizabeth McKenna, Christian Ley, **The Marshall Fire: Scientific and Policy Needs for Water System Disaster Response**, AWWA Water Science, 2023

Friday, December 31:

- 8:00 am: City of Louisville storage tank water levels began to rise
- 12:00pm, snow began to fall, temperature dropped below freezing, storage tank levels were full

- **Boil Advisory issued**
- E-blast sent out
- Calls about what these means



COLORADO
Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

December 31, 2021

ALEX ARINELLO
SUPERIOR MD NO 1 - PWSID CO0107725
127 E COAL CREEK DR
SUPERIOR CO 80027

BOIL WATER ADVISORY - TIER 1 PUBLIC NOTIFICATION REQUIREMENT

Dear ALEX ARINELLO:

This letter serves as formal notification to the SUPERIOR MD NO 1 (the "Supplier") by the Colorado Department of Public Health and Environment-Water Quality Control Division (the "Department") of the requirement to issue a "Boil Water Advisory" to the users of the public water system. This "Boil Water Advisory" is required as a measure to protect public health due to **a line break resulting in a loss of pressure to the system. Loss of pressure may allow disease-causing organisms to enter the water system.**

Section 11.33 of Regulation 11: Colorado Primary Drinking Water Regulations 5 CCR 1002-11 (Regulation 11) requires that public notice be delivered to the Supplier's water users as soon as practical and within **twenty-four (24) hours** of receipt of this letter.

To assist you in fulfilling the public notification requirements, enclosed are copies of the Tier 1 Public Notice Instructions, which includes the "Ten Required Elements of a Public Notice", the Public Notification Template, and the Drinking Water Public Notification "Certificate of Delivery" Form. Please fill in the blanks of the template with language to reflect your specific situation. Additionally, public water suppliers are required to submit a certification of delivery following any type of public notification to verify that all associated public notice activities have been completed in accordance with Regulation 11. The "Tier 1 Public Notice" must be reissued every two weeks until the Department has determined the distribution system is operating properly and providing safe drinking water to the public and has provided the Supplier with written correspondence rescinding the advisory.

In order to properly address the Boil Water Advisory, the officials responsible for managing this public water system must:

- Correct the underlying problem.
- Flush the distribution system in consultation with the Department.
- Obtain water samples from the affected areas of the distribution system and have them analyzed for the presence of total coliform.

Friday, December 31: Morning to Evening

- Power & Gas are out throughout most of town
- Town computer network and e-mail server down
- Emergency Services isolates all destroyed areas of town
- Superior WTP back to normal; tanks full
- Xcel starts restoring power
- Gas still off
- All destroyed homes have water services turned off

Friday, December 31: Damage Assessment

- Superior WTP Back-up Generator & Pump Station destroyed

- Ash in Superior WTP Terminal Reservoir

Sunday, January 2, 2022

- Public Works Directors Meet – Challenging winter conditions
- Crew from Erie arrives to help shut or open water services
- Xcel restores power through most of Town and offers portable heaters for those with gas off
- Requests come in to turn water back on

Monday, January 3, 2022

- Public Works Directors meet
- Request for flushing crews
- Requests come in to turn water back on

- 10 crews with 30 staff from nearby jurisdictions show up
- Water flushing accelerates
- Gas still off in many areas
- Begin removing destroyed vehicles on streets

Wednesday, January 5

- Water flushing complete
- Water samples sent to lab
- Water experts meet
  - CDPHE
  - Purdue University
  - Oregon State University
  - California wildfire-impacted water utilities
  - Corona Environmental
- VOCs concern

Thursday, January 6

- Test results come back passing
- Boil Order lifted
- Gas restored to most areas
- Requests for water turn on pour in
- Residents sift through debris

Key Lessons

1. Internal leadership and commitment
2. Worker safety, power, and water pressure
3. Damage containment
4. Rapid neighbor/mutual aide support
5. Rapid water contamination support
6. Communications

VOC and SVOC Concerns

- Recent California and Oregon wildfire-impacted utilities had widespread occurrence
- Testing methods difficult to nail down and get labs to perform with quick response
- Hundreds of samples collected, analyzed, shared
- Results indicated limited occurrence but legitimate concerns
- Flushing demonstrated to mitigate concerns
- Following talk to describe in much more detail

Superior Smoky Odor Concerns

- Ash deposited in and around terminal reservoir
- Restoring water service was followed by customer complaints
- CSU and CU-Boulder water testing confirmed odor concern
- Bench-scale testing of alternatives by Corona
- GAC design and implementation
- Wednesday talk to describe in much more detail

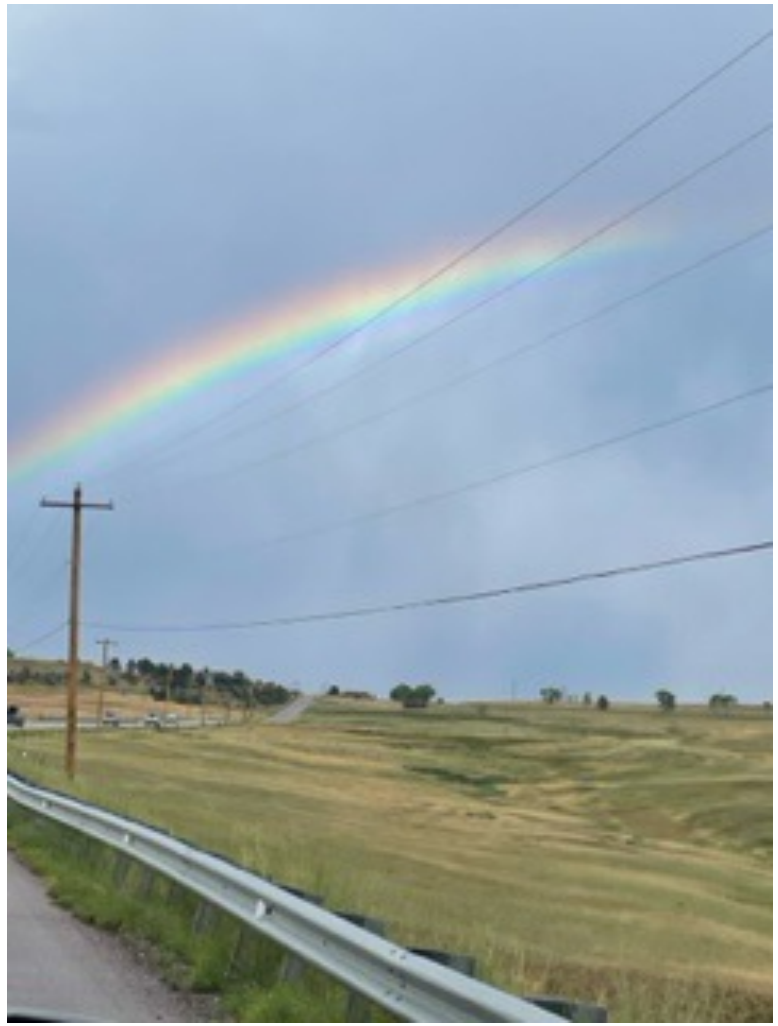
Challenges

- Hydraulic fire-fighting support prompted water contamination concerns
- Wildfire response requires local and external resources
- Contamination types can be varied, localized, and widespread
- Clarification on public notification of health risks and water use conditions is needed
- Standard practices for sampling and laboratory support are needed

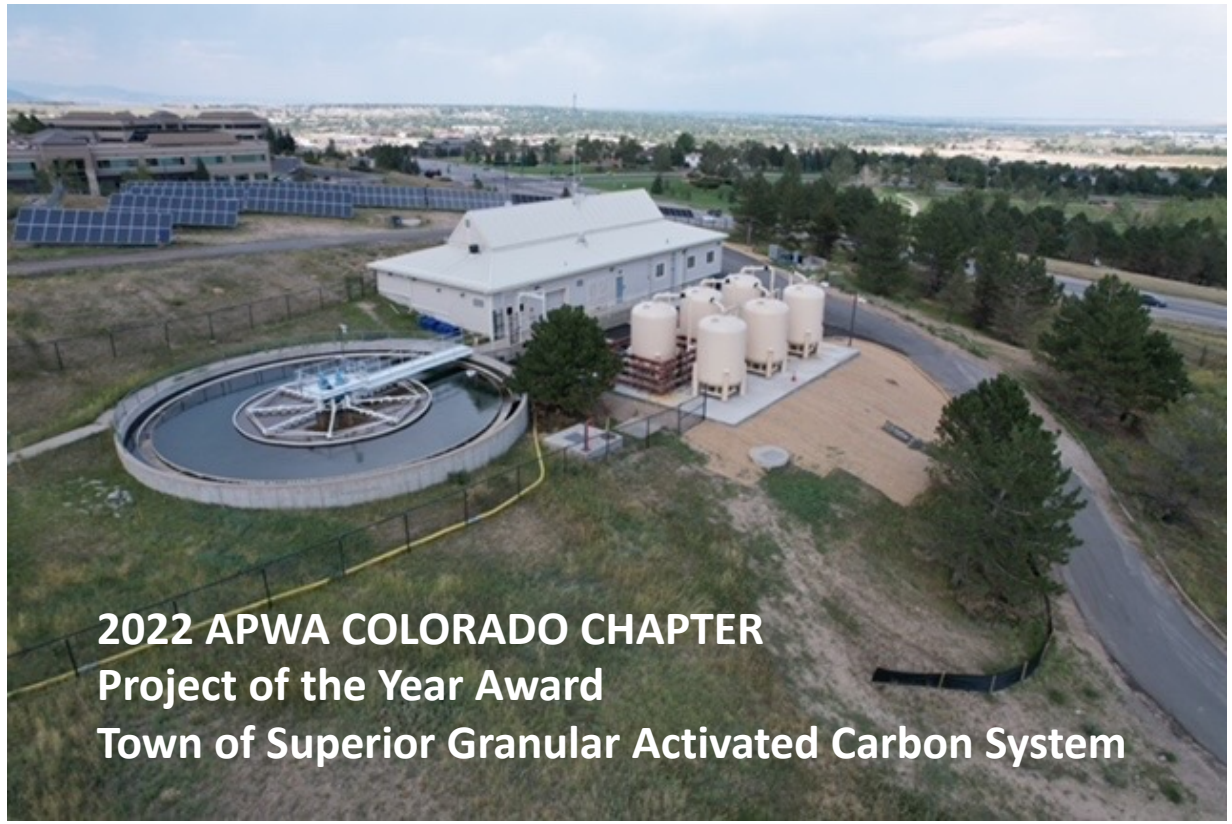
Recommendations to Utilities

- Recognize increasing fire risks
- Implement resilience measures
- Emergency response planning
- Technology to improve water security and interdependencies of utilities
- Collaboration among neighboring water utilities
- Water chemical contaminant sampling and communication methodology

Community is recovering!



Recognitions



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Nathan Talk

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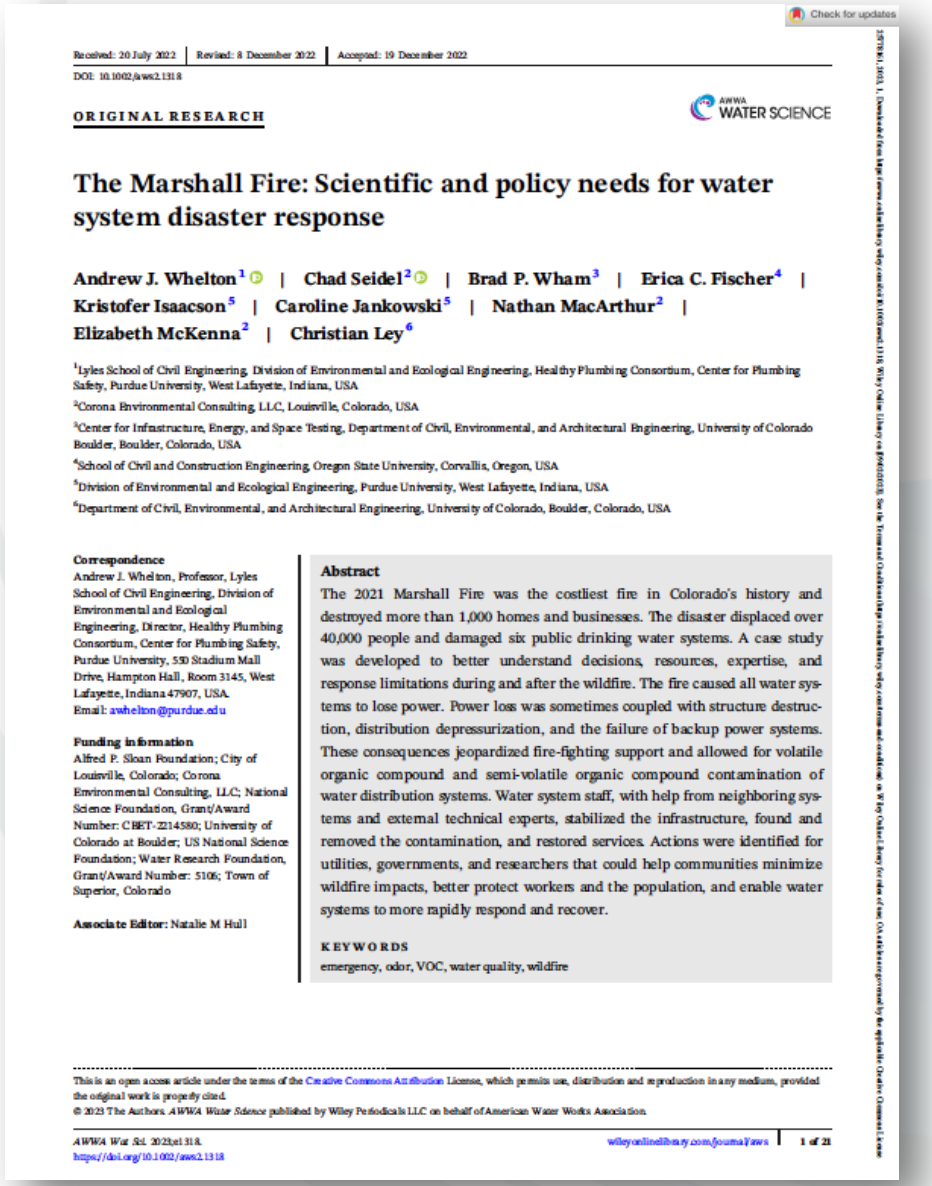
Planning Recommendations for Utilities



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ORIGINAL RESEARCH

AWWA WATER SCIENCE

The Marshall Fire: Scientific and policy needs for water system disaster response

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Associate Editor: Natalie M Hull

Abstract

The 2021 Marshall Fire was the costliest fire in Colorado's history and destroyed more than 1,000 homes and businesses. The disaster displaced over 40,000 people and damaged six public drinking water systems. A case study was developed to better understand decisions, resources, expertise, and response limitations during and after the wildfire. The fire caused all water systems to lose power. Power loss was sometimes coupled with structure destruction, distribution depressurization, and the failure of backup power systems. These consequences jeopardized fire-fighting support and allowed for volatile organic compound and semi-volatile organic compound contamination of water distribution systems. Water system staff, with help from neighboring systems and external technical experts, stabilized the infrastructure, found and removed the contamination, and restored services. Actions were identified for utilities, governments, and researchers that could help communities minimize wildfire impacts, better protect workers and the population, and enable water systems to more rapidly respond and recover.

KEYWORDS
emergency, odor, VOC, water quality, wildfire

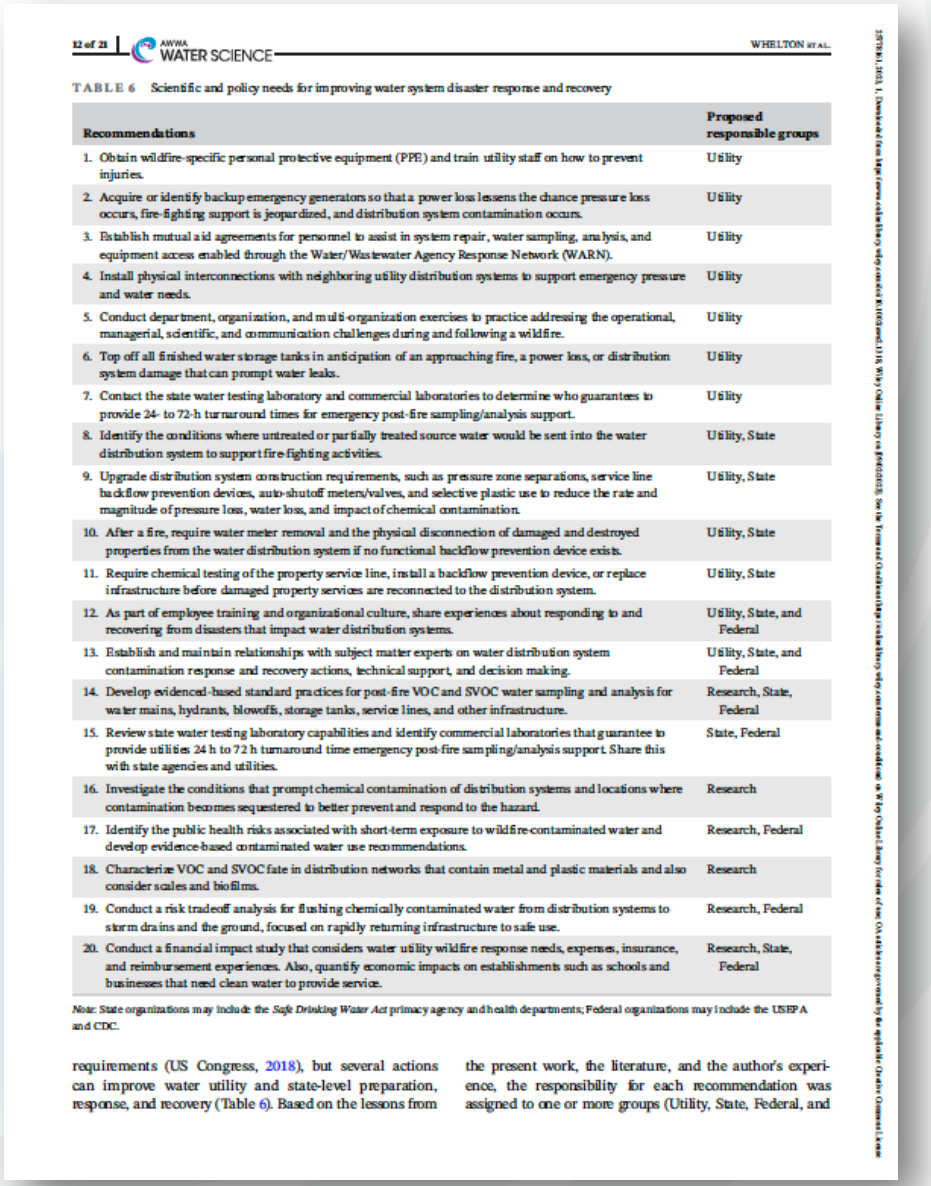

TABLE 6 Scientific and policy needs for improving water system disaster response and recovery

Recommendations	Proposed responsible groups
1. Obtain wildfire-specific personal protective equipment (PPE) and train utility staff on how to prevent injuries.	Utility
2. Acquire or identify backup emergency generators so that a power loss lessens the chance pressure loss occurs, fire-fighting support is jeopardized, and distribution system contamination occurs.	Utility
3. Establish mutual aid agreements for personnel to assist in system repair, water sampling, analysis, and equipment access enabled through the Water/Wastewater Agency Response Network (WARN).	Utility
4. Install physical interconnections with neighboring utility distribution systems to support emergency pressure and water needs.	Utility
5. Conduct department, organization, and multi-organization exercises to practice addressing the operational, managerial, scientific, and communication challenges during and following a wildfire.	Utility
6. Top off all finished water storage tanks in anticipation of an approaching fire, a power loss, or distribution system damage that can prompt water leaks.	Utility
7. Contact the state water testing laboratory and commercial laboratories to determine who guarantees to provide 24- to 72-h turnaround times for emergency post-fire sampling/analysis support.	Utility
8. Identify the conditions where untreated or partially treated source water would be sent into the water distribution system to support fire-fighting activities.	Utility, State
9. Upgrade distribution system construction requirements, such as pressure zone separations, service line backflow prevention devices, auto-shutoff meters/valves, and selective plastic use to reduce the rate and magnitude of pressure loss, water loss, and impact of chemical contamination.	Utility, State
10. After a fire, require water meter removal and the physical disconnection of damaged and destroyed properties from the water distribution system if no functional backflow prevention device exists.	Utility, State
11. Require chemical testing of the property service line, install a backflow prevention device, or replace infrastructure before damaged property services are reconnected to the distribution system.	Utility, State
12. As part of employee training and organizational culture, share experiences about responding to and recovering from disasters that impact water distribution systems.	Utility, State, and Federal
13. Establish and maintain relationships with subject matter experts on water distribution system contamination response and recovery actions, technical support, and decision making.	Utility, State, and Federal
14. Develop evidenced-based standard practices for post-fire VOC and SVOC water sampling and analysis for water mains, hydrants, blowoffs, storage tanks, service lines, and other infrastructure.	Research, State, Federal
15. Review state water testing laboratory capabilities and identify commercial laboratories that guarantee to provide utilities 24 h to 72 h turnaround time emergency post-fire sampling/analysis support. Share this with state agencies and utilities.	State, Federal
16. Investigate the conditions that prompt chemical contamination of distribution systems and locations where contamination becomes sequestered to better prevent and respond to the hazard.	Research
17. Identify the public health risks associated with short-term exposure to wildfire-contaminated water and develop evidence-based contaminated water use recommendations.	Research, Federal
18. Characterize VOC and SVOC fate in distribution networks that contain metal and plastic materials and also consider scales and biofilms.	Research
19. Conduct a risk tradeoff analysis for flushing chemically contaminated water from distribution systems to storm drains and the ground, focused on rapidly returning infrastructure to safe use.	Research, Federal
20. Conduct a financial impact study that considers water utility wildfire response needs, expenses, insurance, and reimbursement experiences. Also, quantify economic impacts on establishments such as schools and businesses that need clean water to provide service.	Research, State, Federal

Note: State organizations may include the *Safe Drinking Water Act* primacy agency and health departments; Federal organizations may include the USEPA and CDC.

requirements (US Congress, 2018), but several actions can improve water utility and state-level preparation, response, and recovery (Table 6). Based on the lessons from the present work, the literature, and the author's experience, the responsibility for each recommendation was assigned to one or more groups (Utility, State, Federal, and

Planning Recommendations for Utilities

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Thank you!!!

February 13, 2023

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