



# Building City of Durango Water Supply Resiliency

Lake Nighthorse water storage and access

Photo: [thedurangoteam.com](http://thedurangoteam.com)

# Colorado Water Conservation Board 2022 SW Basin Challenges for Municipal and Industrial Sectors

“The Pagosa Springs-Bayfield-Durango corridor is rapidly growing while experiencing areas of localized water shortages”

“Existing reservoirs storing municipal and industrial water lack infrastructure to deliver water to treatment plants and distribution systems”







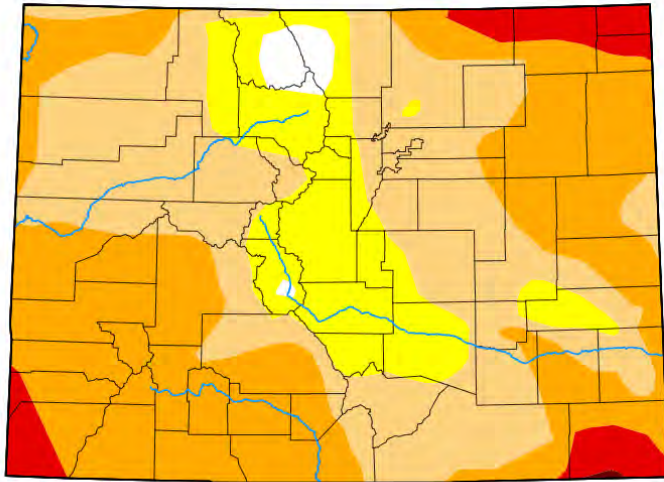
# Our System

- Florida watershed is the primary source
  - Higher water quality compared to the Animas
  - Significant senior water rights (8.92 CFS)
  - Calls have limited intake to 6.167 twice in the past
  - Gravity driven system
  - Transported by an ageing, nine-mile raw water pipe to Terminal reservoir
- Animas Watershed in the supplementary source
  - Significant senior water rights (46.92 CFS)
  - Lower water quality due to high levels of mineralization
  - Requires pumping
- Terminal reservoir is the only storage
  - 10 days of storage at peak demand

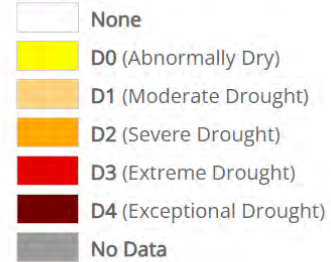


Map released: Thurs. July 7, 2022

Data valid: July 5, 2022 at 8 a.m. EDT



#### Intensity



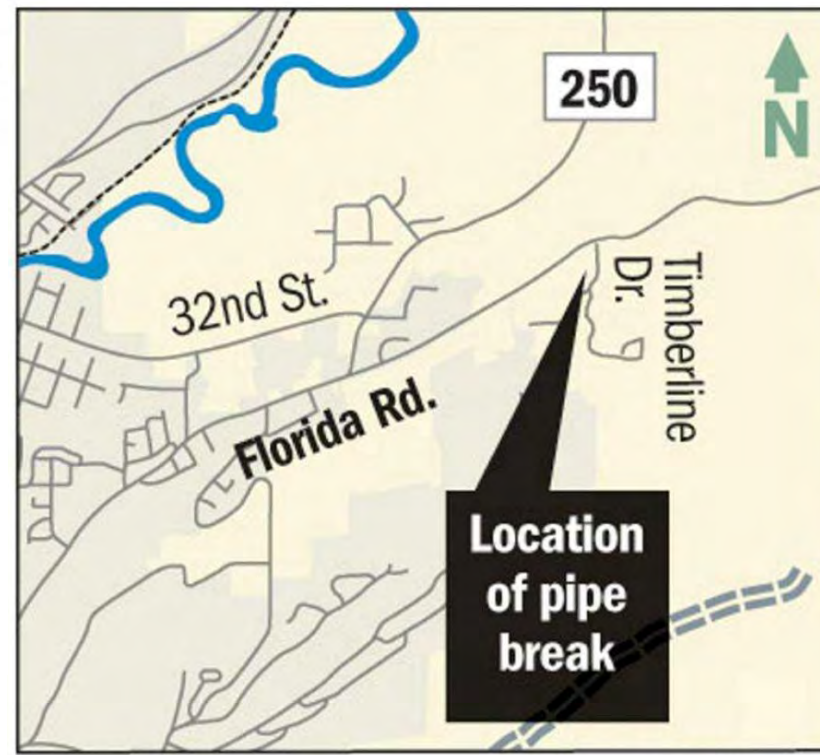
#### Authors

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Durango Herald

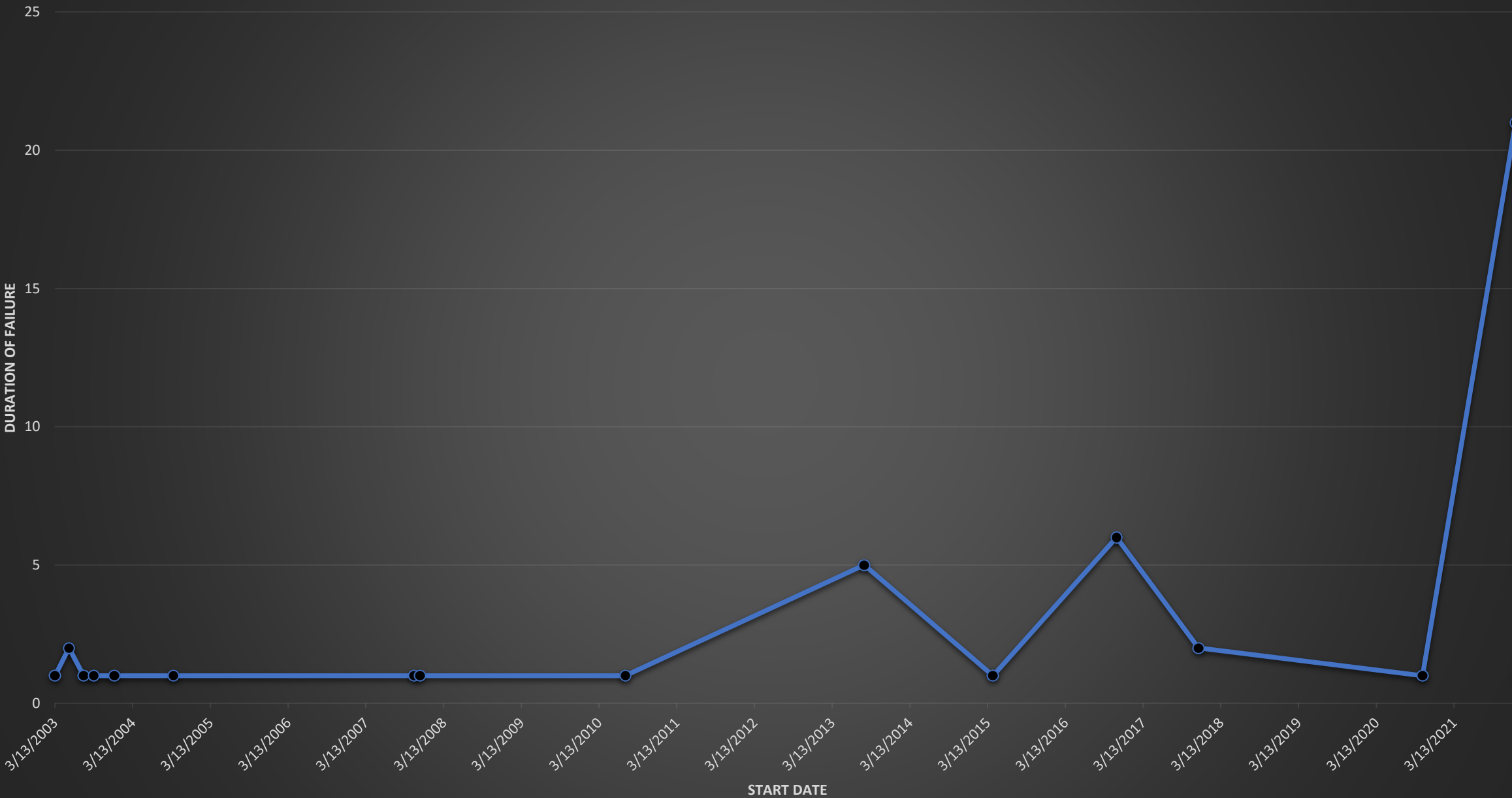
## System Risks

1. Aging Infrastructure
2. Drought and aridification
3. Unplanned mine release
4. Wildfire



Photo: Durango Herald

# Days of Florida Pipeline Failure





# Changes in water supply - Florida River

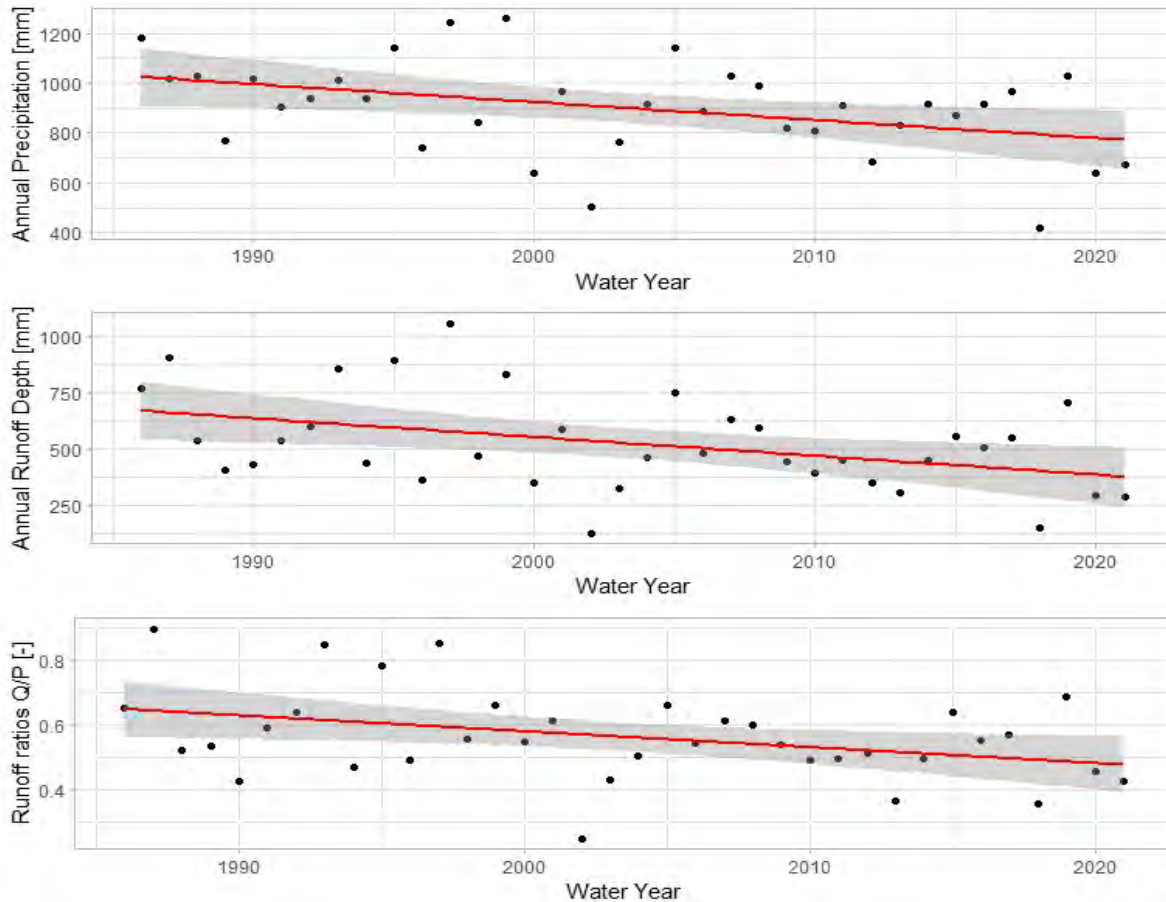


Photo: Durango Herald



# Changes in water supply - Animas River

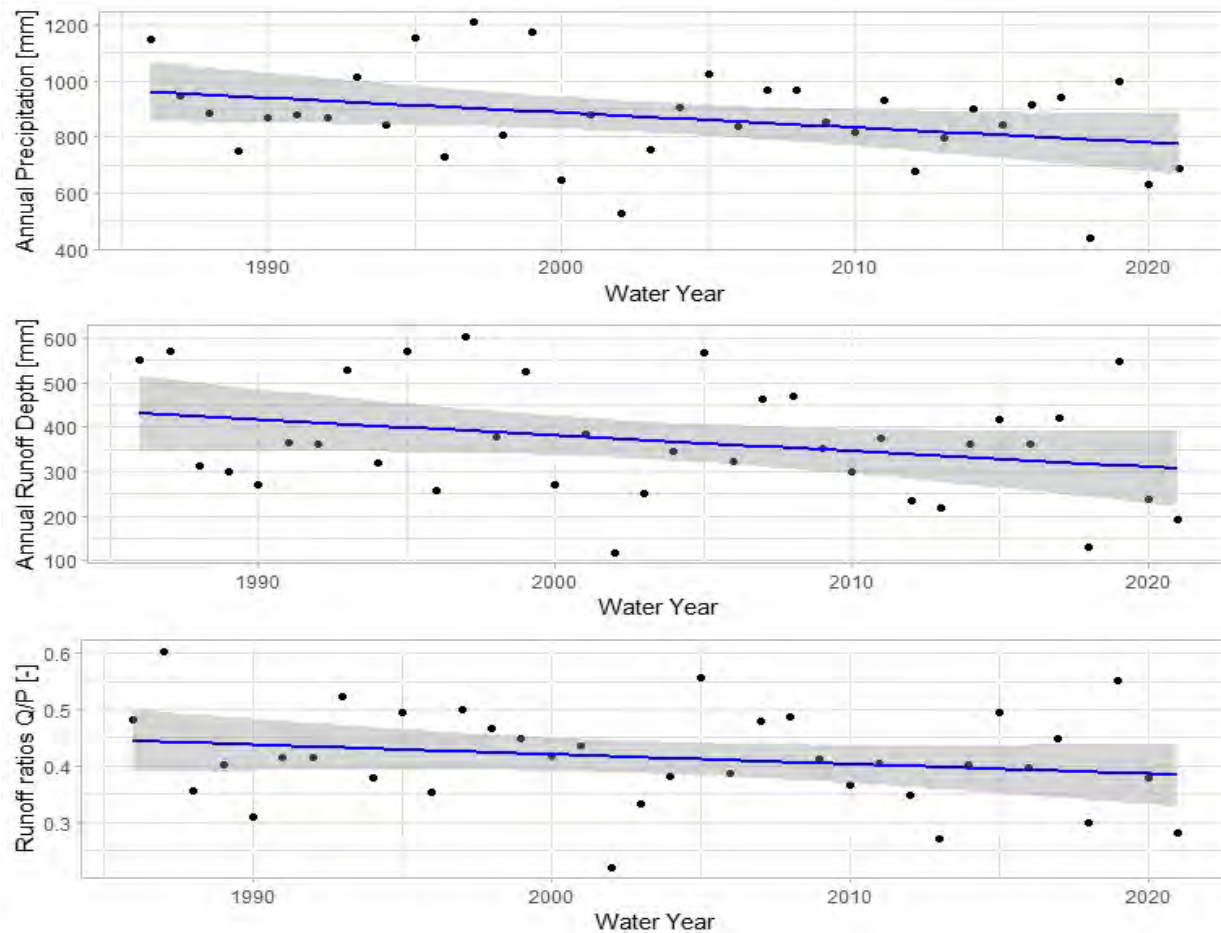
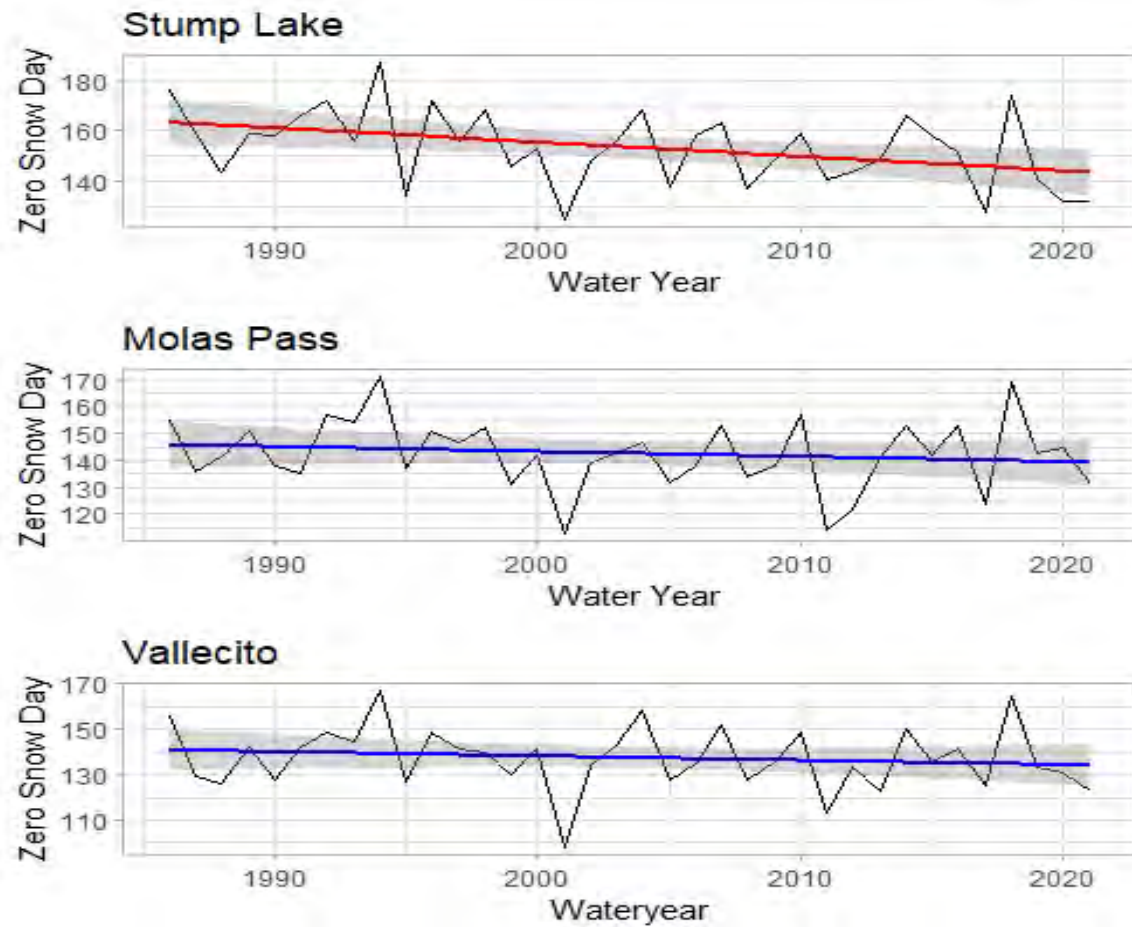


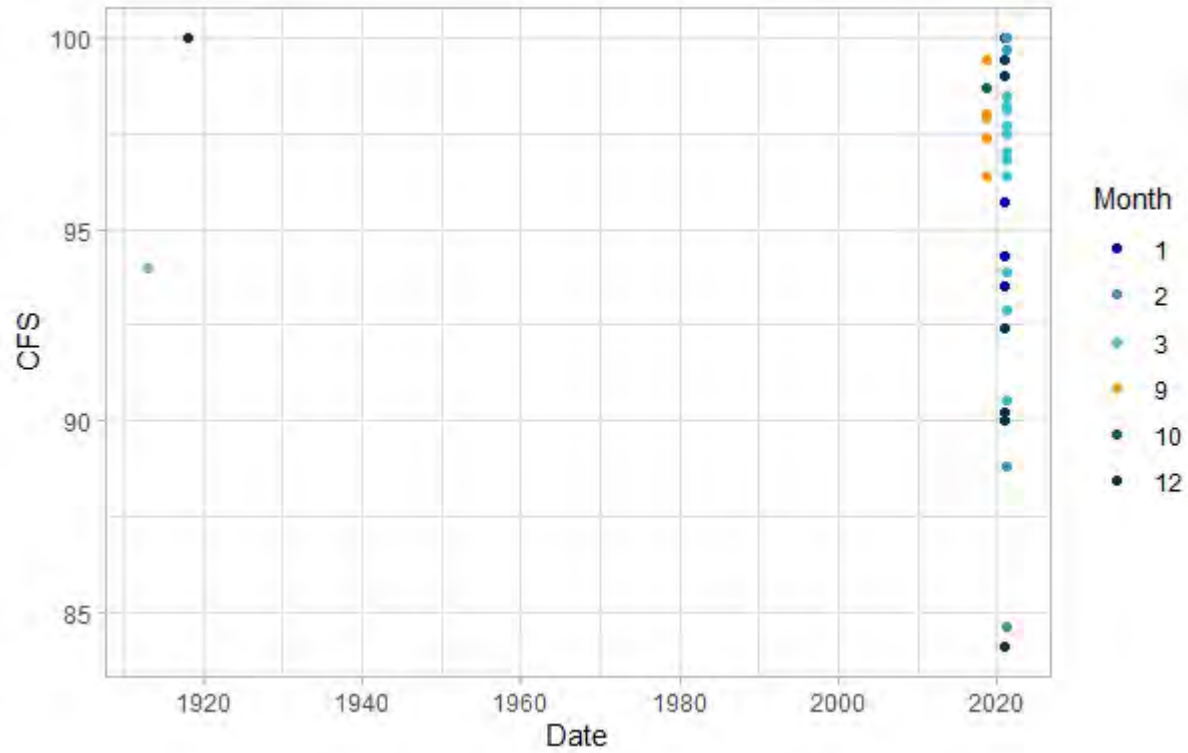
Photo: [www.uncovercolorado.com](http://www.uncovercolorado.com)



# Change in Snow Melt out Dates







# Days with less than 100CFS in the Animas

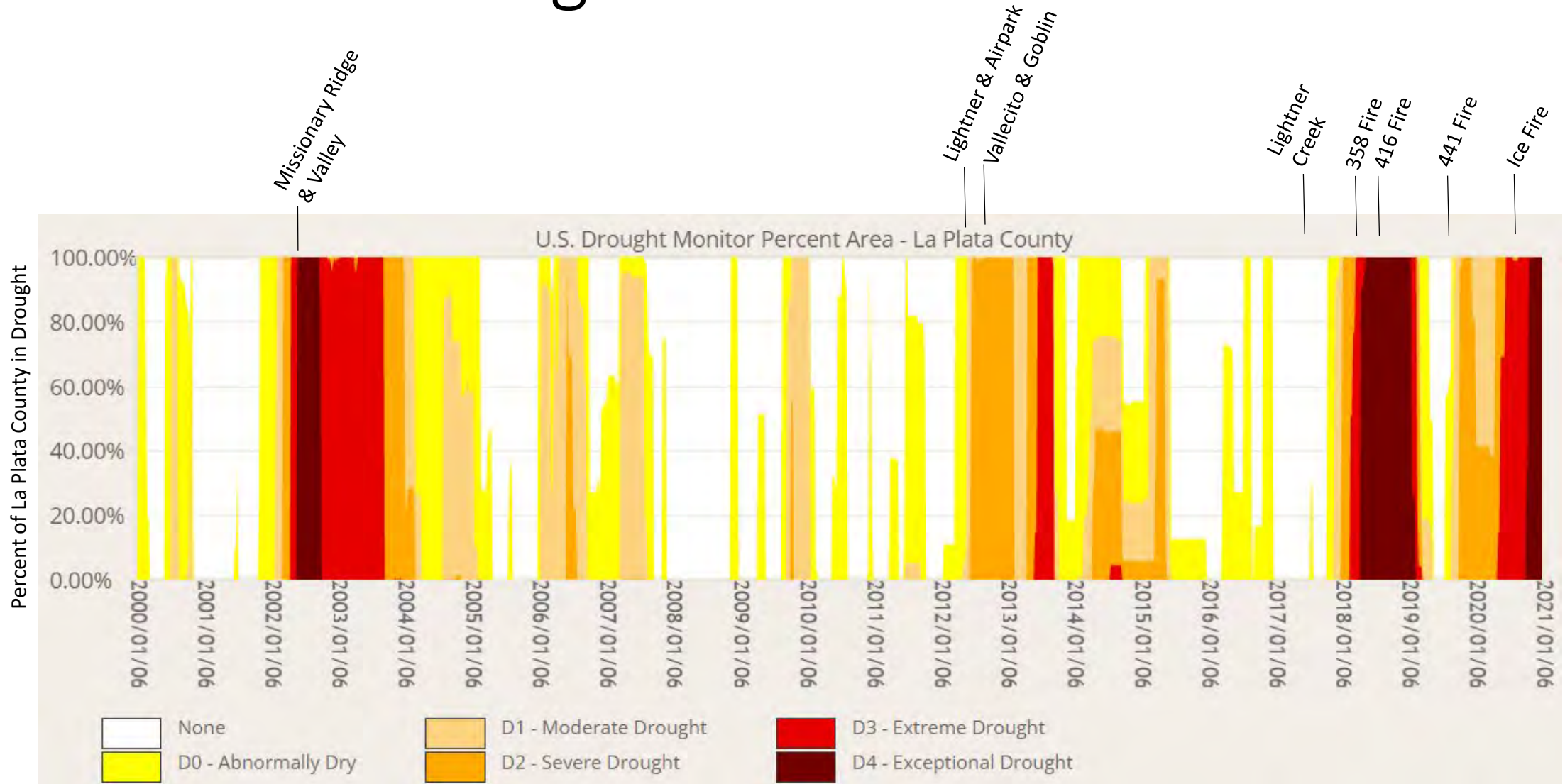




# Unplanned Mine Release

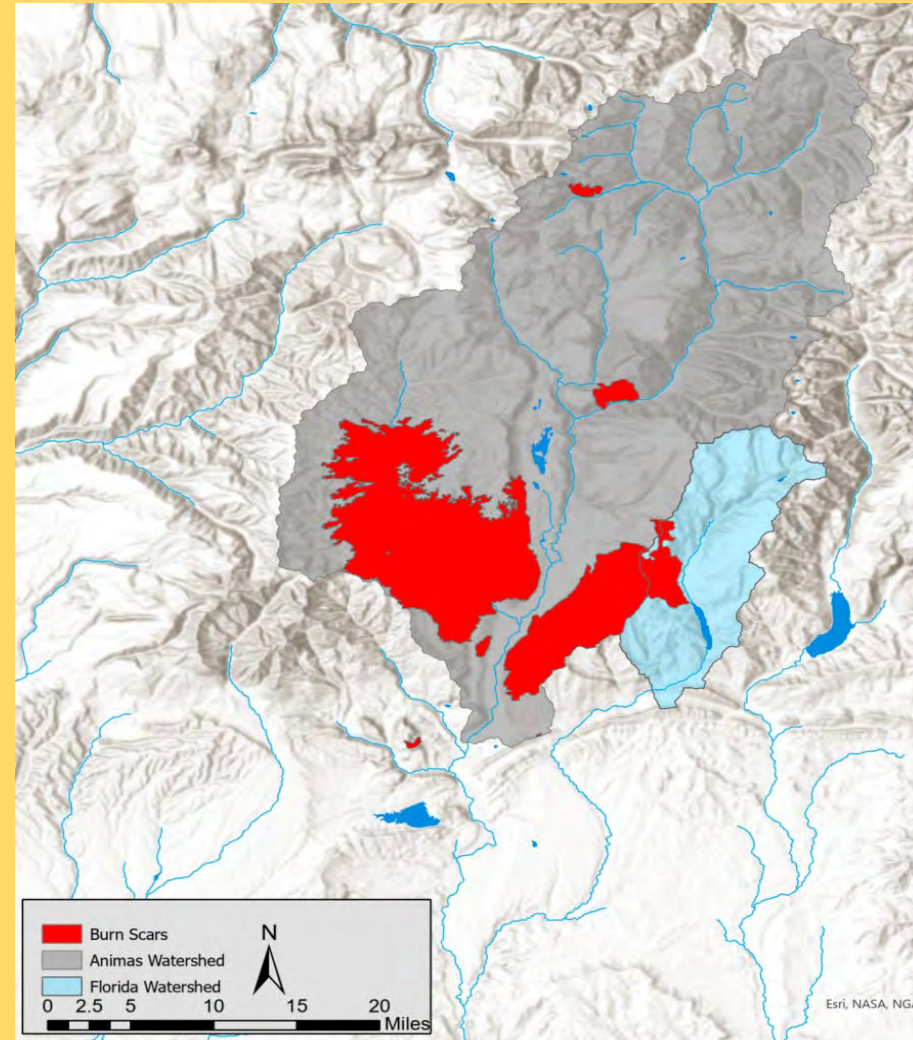
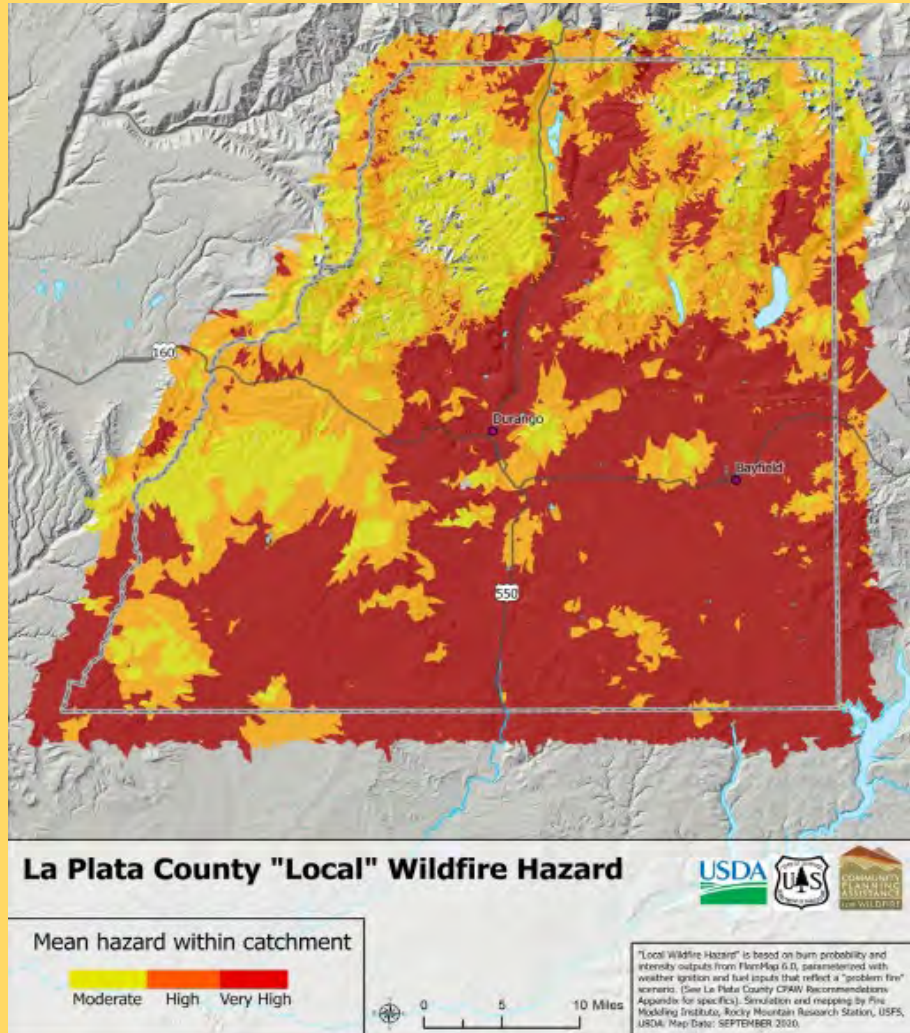


# Wildfires are increasing in frequency with increased drought





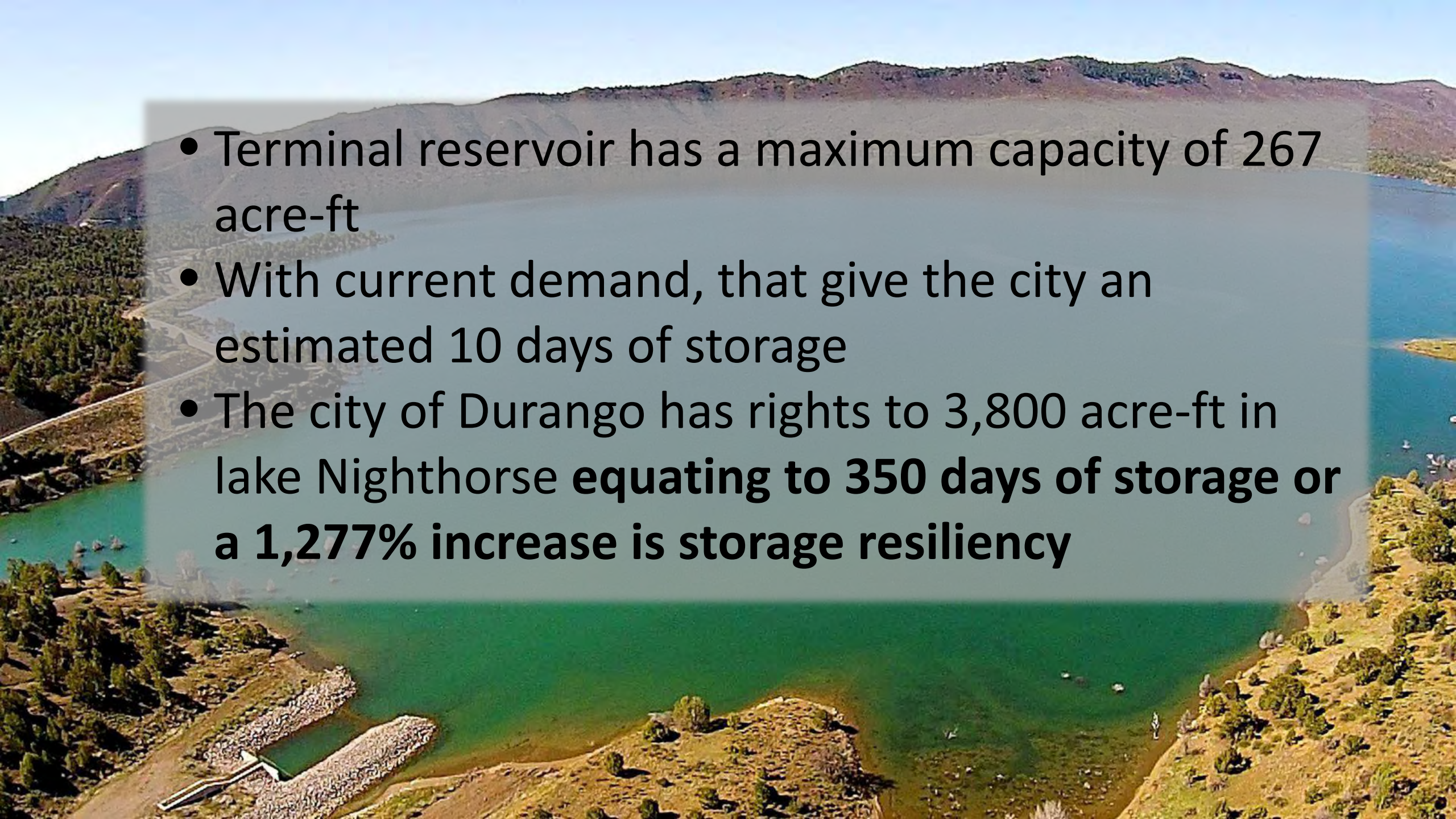
# Wildfire Risk



Consequences of wildfire on water treatment:

- Increased treatment costs to deal with degraded water quality
- Excessive manganese can cause growth of microorganisms problematic for treatment
- Increased dissolved organic carbon may form unwanted by-products during disinfection (carcinogens: chloroform and trihalomethanes)



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- An aerial photograph of a large reservoir, likely Nighthorse Lake, with a dam visible in the lower left. The water is a deep green color, and the surrounding landscape is arid with sparse vegetation and mountains in the background. A semi-transparent grey box is overlaid on the image, containing a bulleted list of facts about the reservoir's capacity and storage rights.
- Terminal reservoir has a maximum capacity of 267 acre-ft
  - With current demand, that give the city an estimated 10 days of storage
  - The city of Durango has rights to 3,800 acre-ft in lake Nighthorse **equating to 350 days of storage or a 1,277% increase is storage resiliency**



# Funding is Available



Water storage and supply: Includes development of additional storage, artificial recharge into aquifers, and dredging existing reservoirs to restore the reservoirs' full decreed storage capacity for multi-beneficial projects, collaborative water sharing agreements, and projects identified in BIPs to address the water supply and demand gap.



“This funding opportunity and the WaterSMART Program as a whole are part of the Department’s strategy to tackle the short- and long-term challenge of climate change by improving water use and supply efficiency, sustainability, and reliability.”

Assistant Secretary for Water and Science Tanya Trujillo

## Southwest Basin Roundtable

- Technical assistance regarding permitting, feasibility studies and environmental compliance.
- Studies or analysis of structural, programmatic, consumptive and non-consumptive water projects or activities.
- Design of structural projects or activities.
- Infrastructure replacement or maintenance projects.



# Data sources

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## Precipitation

- Precipitation data was taken from the Parameter-elevation Regression on Independent Slopes Model (PRISM)
- Daly, C., R.P. Neilson, and D.L. Phillips. 1994. [A statistical-topographic model for mapping climatological precipitation over mountainous terrain](https://doi.org/10.1175/1520-0450(1994)033<0140:ASTMFM>2.0.CO;2). *Journal of Applied Meteorology* 33(2): 140-158. [doi:10.1175/1520-0450\(1994\)033<0140:ASTMFM>2.0.CO;2](https://doi.org/10.1175/1520-0450(1994)033<0140:ASTMFM>2.0.CO;2)
- <https://prism.oregonstate.edu/>
- These data were selected as they are more representative of the watersheds and a more conservative estimate of rain input into the system compared to a single, low elevation met station.

## Streamflow

- Streamflow analysis for the Florida was accomplished using Colorado's Division of Water Resource gage – FLOALECO – Florida River Above Lemon Reservoir Near Durango #3002212
- Streamflow analysis for the Animas was accomplished using the United States Geological Survey gage – Animas River at Durango #09361500

## Drought

- Information on drought was taken from the Drought Risk Atlas
- The Vallecito Dam station # 058582 was used, and the analysis was done at the county level for La Plata county
- <https://droughtatlas.unl.edu>

## Current system demands and storage

- All calculation for water storage are based on the City of Durango Water Maser Plan
- O'Neal, P., Ledin, J., & Katzenberger, C. (2021). *Water System Master Plan*. Durango, CO.



# Citations

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- CWCBC. (2022). *Colorado Water Plan*.
- Karau, E., Johnston, K., & Mower, M. (2020). Final Recommendations to Reduce Wildfire Risk to Communities: La Plata County, Colorado. Final Recommendations to Reduce Wildfire Risk to Communities: La Plata County, Colorado. Retrieved from <https://planningforwildfire.org>
- O'Neal, P., Ledin, J., & Katzenberger, C. (2021). *Water System Master Plan*. Durango, CO.
- <https://www.usbr.gov/watersmart/>
- <https://waterinfo.org/resources/southwest-basin-roundtable/>

Additional references :

Fire impacts on water quality

- <https://pubs.usgs.gov/of/2004/1296/>
- <https://www.sciencedirect.com/science/article/abs/pii/S0048969716301656>
- <https://pubs.acs.org/doi/10.1021/acs.accounts.8b00670>

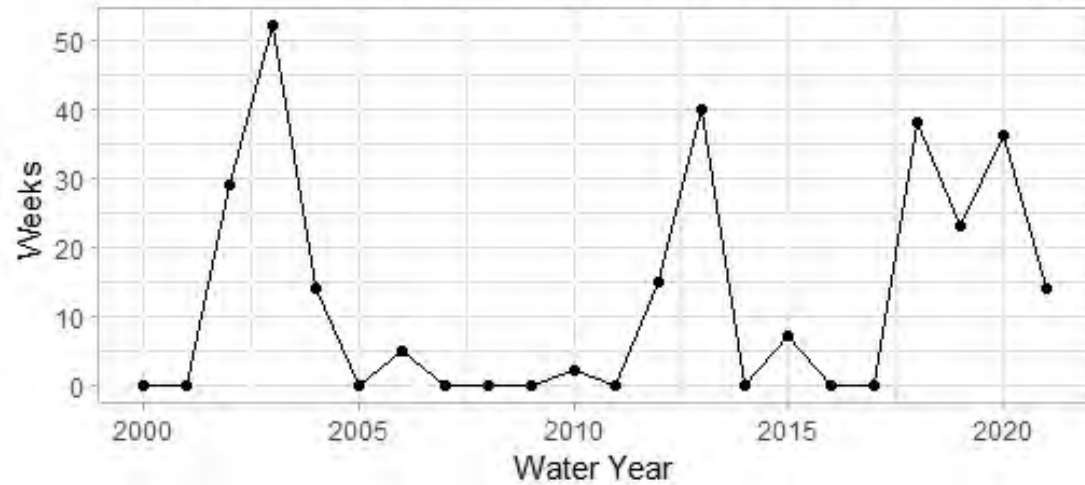
Colorado stream flow and snowpack:

- <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021EA002086>
- <https://onlinelibrary.wiley.com/doi/full/10.1111/1752-1688.13021>

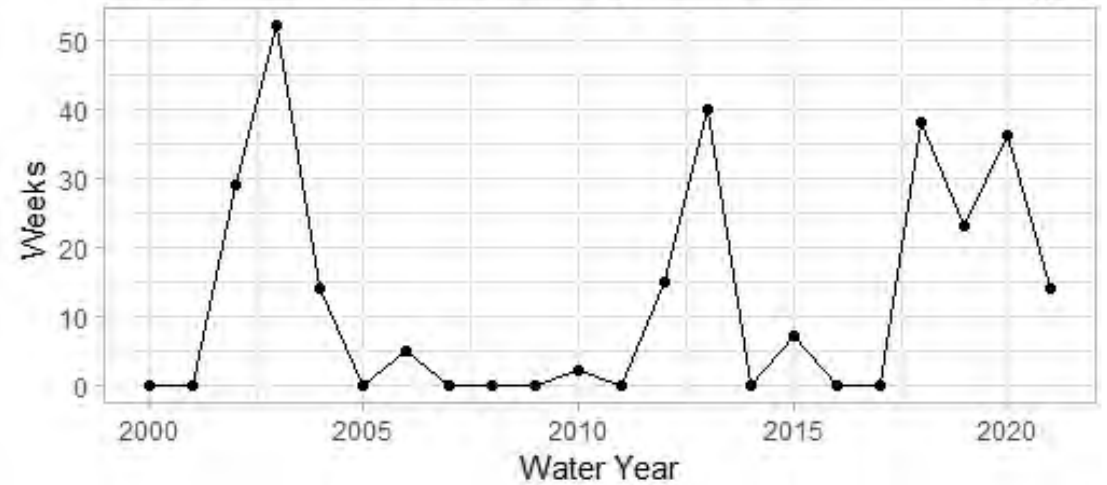


# La Plata County Drought frequency

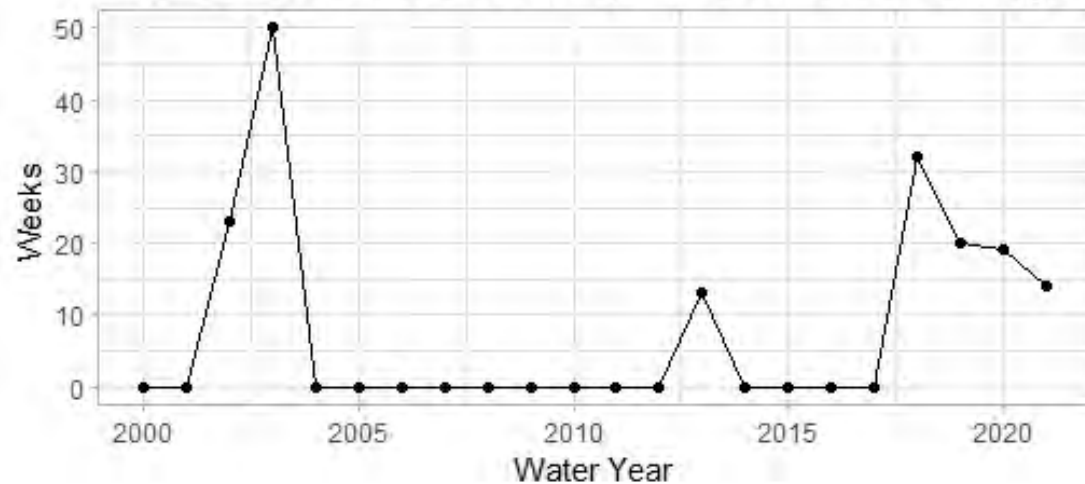
Weeks with 50% of the County or more in D1-D4 Drought



Weeks with 50% of the County or more in D2-D4 Drought



Weeks with 50% of the County or more in D3-D4 Drought



Weeks with 50% of the County or more in D4 Drought

