CALIFORNIA DEPARTMENT OF WATER RESOURCES

Assessment of Camp Fire Impacts to Lake Oroville

North Fork Feather River Canyon, Pre- and Post-Fire

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Camp Fire Water Resources
Monitoring and Research Symposium
June 4, 2019

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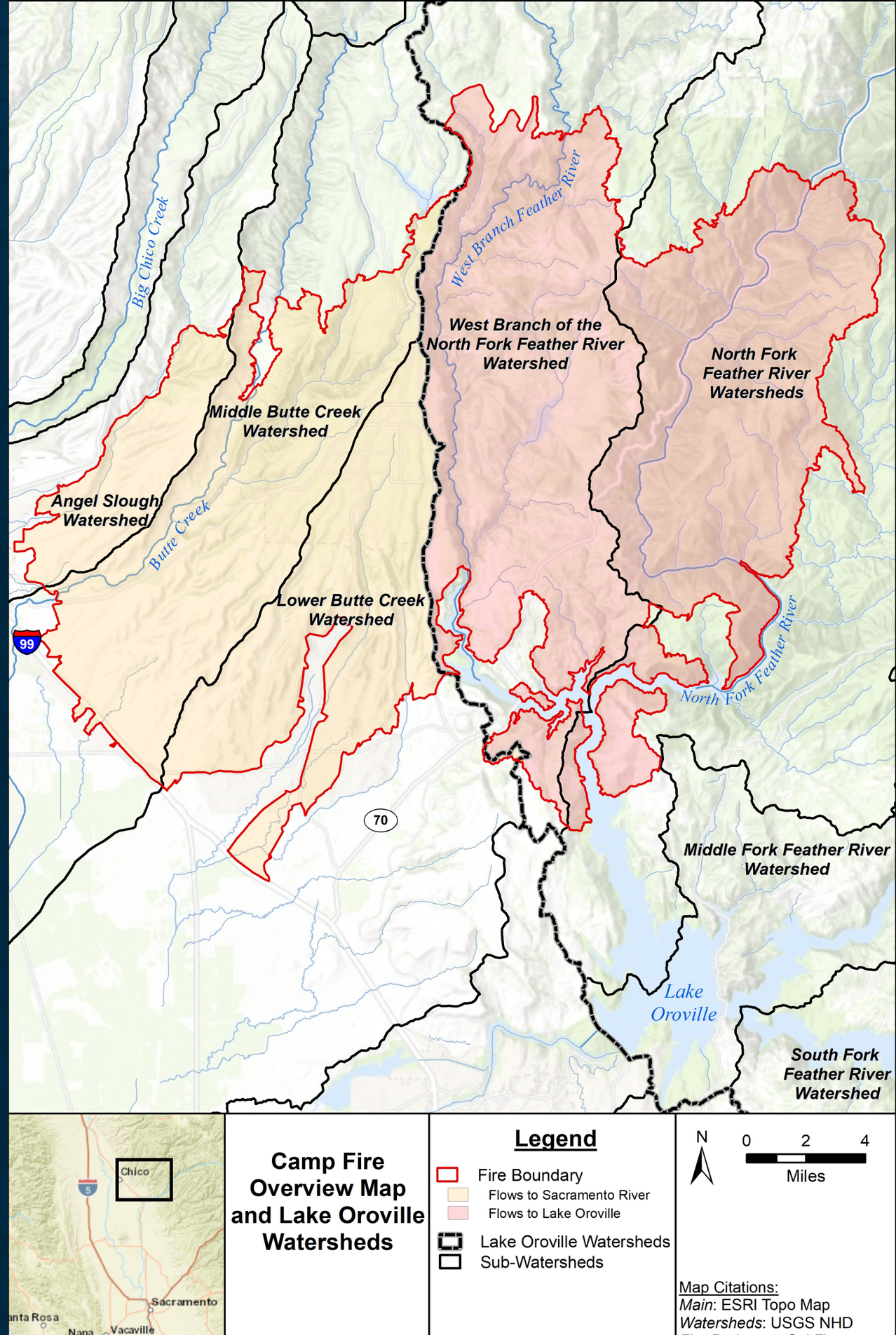
Lake Oroville & Fire Boundary

- SWP facility
  - Managed by DWR
- Multiple beneficial uses
  - Recreation
  - Water storage and power generation
  - Source of local drinking water
  - Terrestrial and aquatic habitat



Debris Flow Potential

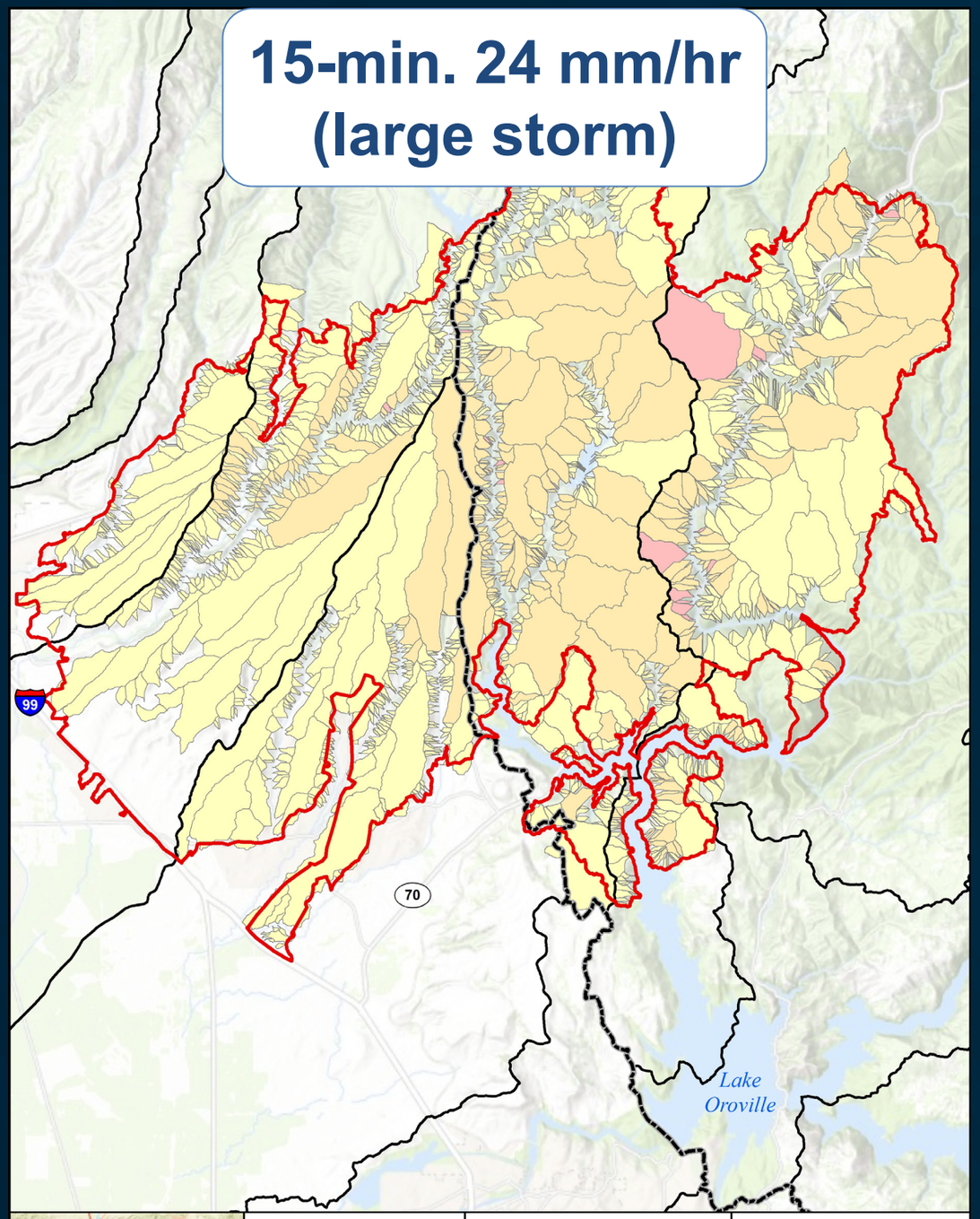
Large areas of the North Fork Feather River Watersheds were severely burned

→ Severely burned areas lead to larger runoff volumes

→ Large runoff volume may potentially cause debris flows, mudslides, & excess run-off

- Even small erosion sites have potential to produce large effects over time
- Burn area severity surveys and potential debris flow maps produced by USGS

Debris Flow Probability Maps



Combined Debris Flow Hazard Classification (15-min. 24mm/hr)

Legend

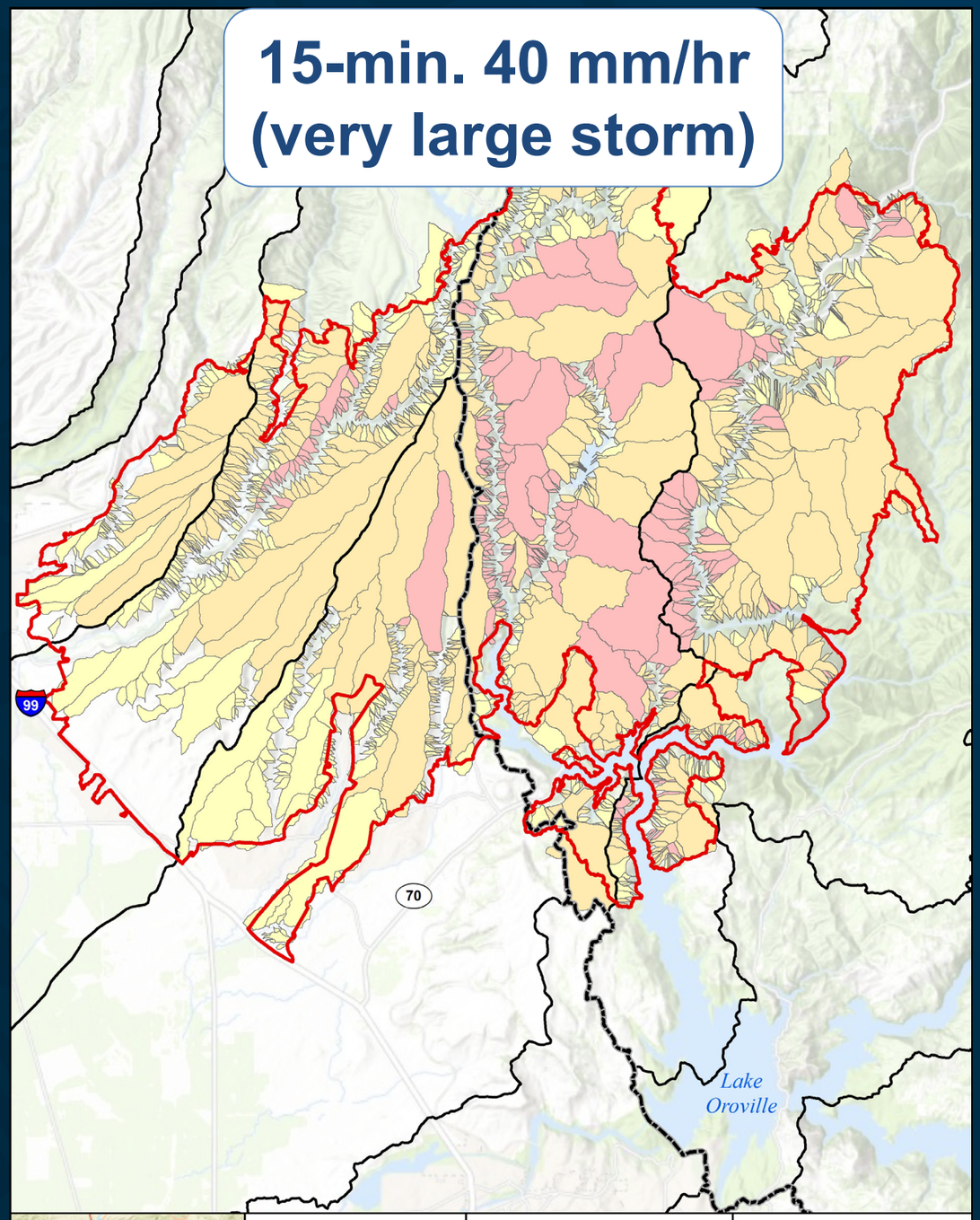
- Fire Boundary
- Lake Oroville Watersheds
- Sub-Watersheds

Debris Flow Hazard Class.

- Low
- Moderate
- High

N 0 2 4 Miles

Map Citations:
Main: ESRI Topo Map
Watersheds: USGS NHD
Fire Perimeter: Cal Fire
Basin Hazard: USGS Landslide Hazards Program



Combined Debris Flow Hazard Classification (15-min. 40mm/hr)

Legend

- Fire Boundary
- Lake Oroville Watersheds
- Sub-Watersheds

Debris Flow Hazard Class.

- Low
- Moderate
- High

N 0 2 4 Miles

Map Citations:
Main: ESRI Topo Map
Watersheds: USGS NHD
Fire Perimeter: Cal Fire
Basin Hazard: USGS Landslide Hazards Program

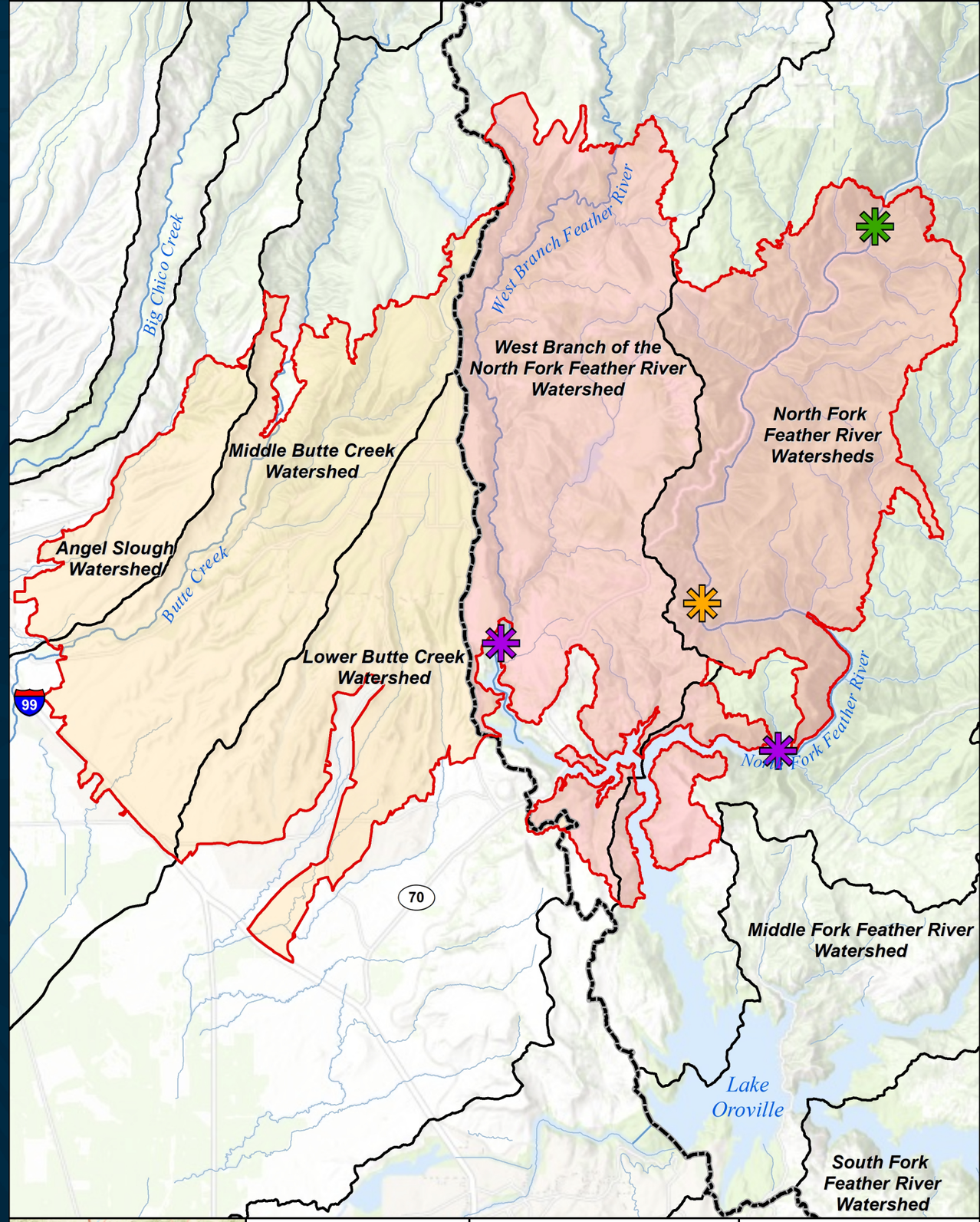
Potential Impacts to Lake Oroville

- Increased sediment and solids
- Increased metals and minerals
- Increased nutrients (potential algae blooms)
- Inflows of combustion related toxins (PAHs)
- Impacts to Lake Oroville 303d listed compounds
  - Impaired for mercury and PCBs
  - 303d list is compiled by SWRCB

Sampling Locations

Very remote area with few roads. Safety, access, and representativeness were taken into account in site selection.

- 1 location upstream of the burned area
- 1 location upstream of Lake Oroville
- 2 locations in the upper arms of Lake Oroville (boat sites)



Lake Oroville Watersheds Sample Locations

Legend

- Fire Boundary
  - Flows to Sacramento River
  - Flows to Lake Oroville
- Lake Oroville Watersheds
- Sub-Watersheds
- Sample Sites

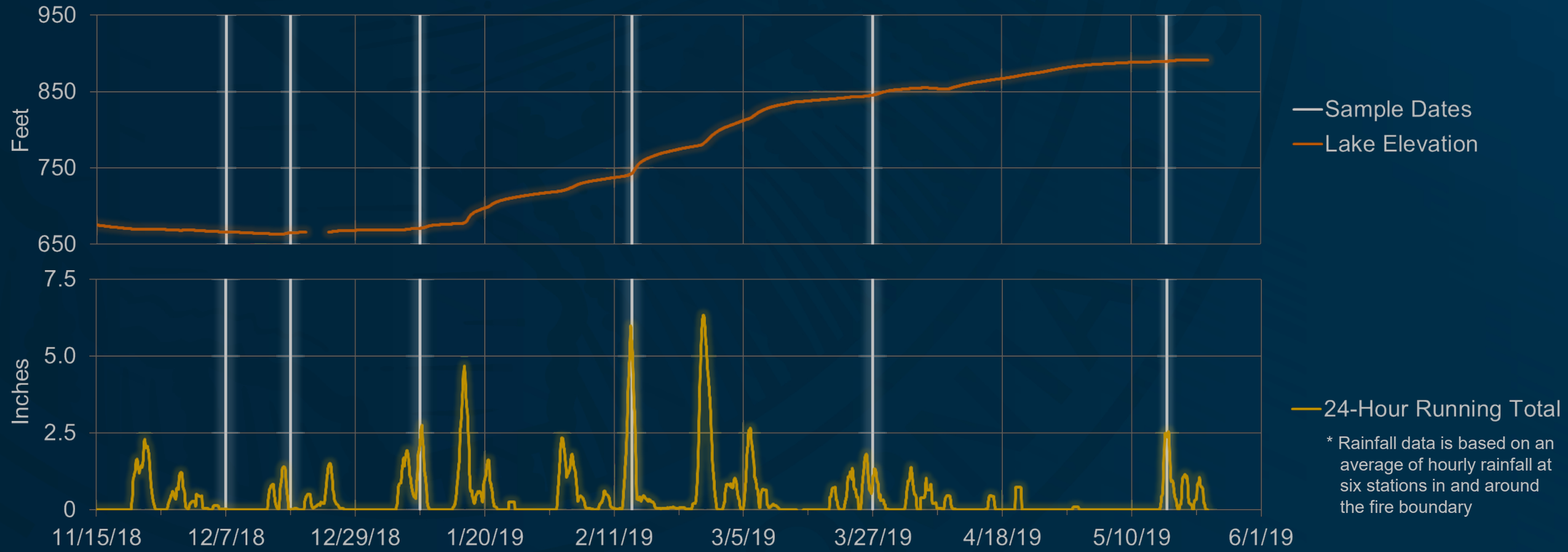
N

0 2 4 Miles

Map Citations:
Main: ESRI Topo Map
Watersheds: USGS NHD
Fire Perimeter: Cal Fire

Sampling Dates

- Collected samples during or after heavy storms
  - Missed first flush event, occurred during the fire
  - First samples 12 days after 100% containment
  - Spread samples throughout Winter and into Spring
  - No sample in April, one sample in May (data pending)

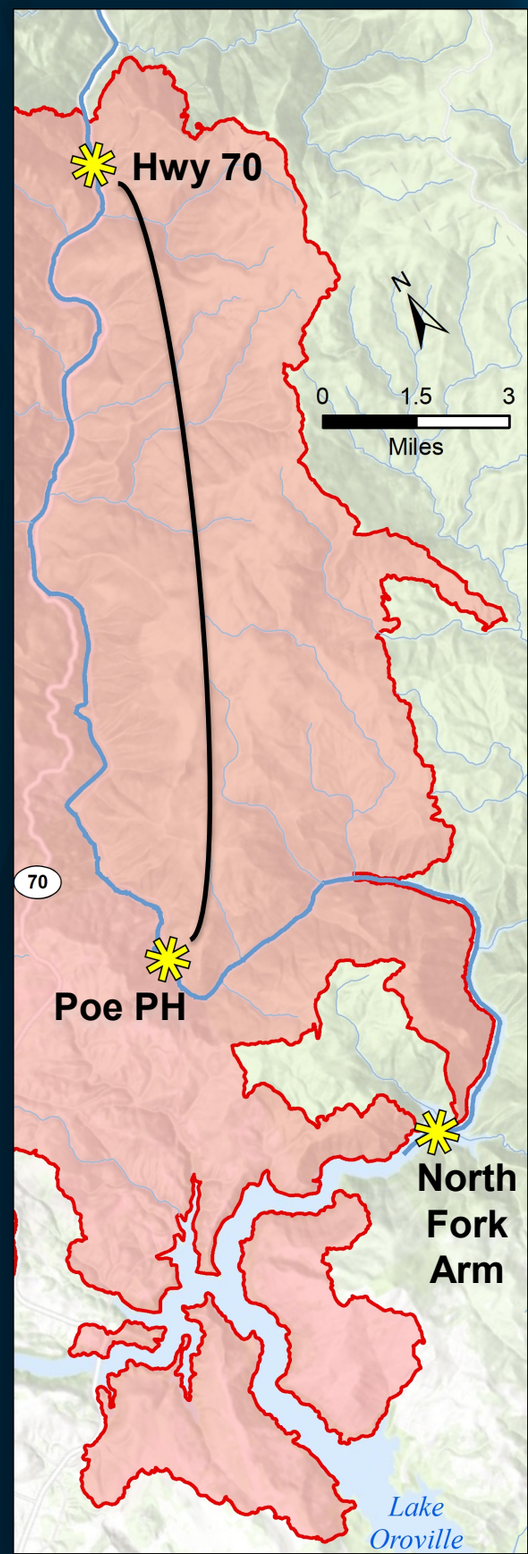


Analytes and Methods

- Analyte list modeled after Carr Fire and other Camp Fire sampling plans
  - Metals, nutrients, minerals, solids, PAHs, plus PCBs
- Collected with Van Dorn or steel bucket
  - Dissolved samples filtered in field
  - Analyzed at DWR's Bryte Lab or TestAmerica Labs
- Physicals measured with YSI ProDSS

Preliminary North Fork Results

- Hwy 70 (upstream of the fire) vs. Poe PH (upstream of Lake Oroville)
  - Not affected by lake effects (next slide)
  - Largest, consistent increases shown below
    - Table shows average increase over all dates
    - Common soil-related parameters
    - Largest increases were in the first sample set
  - No PCBs or PAHs detected



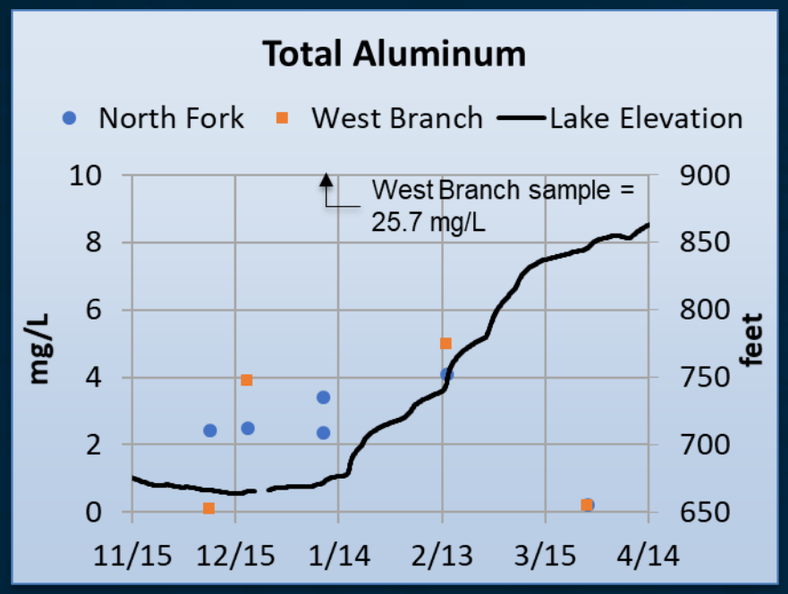
Analyte	Average RPD
T. Aluminum # +	319%
T. Iron # +	124%
T. Manganese # +	138%
T. Nickel +	143%

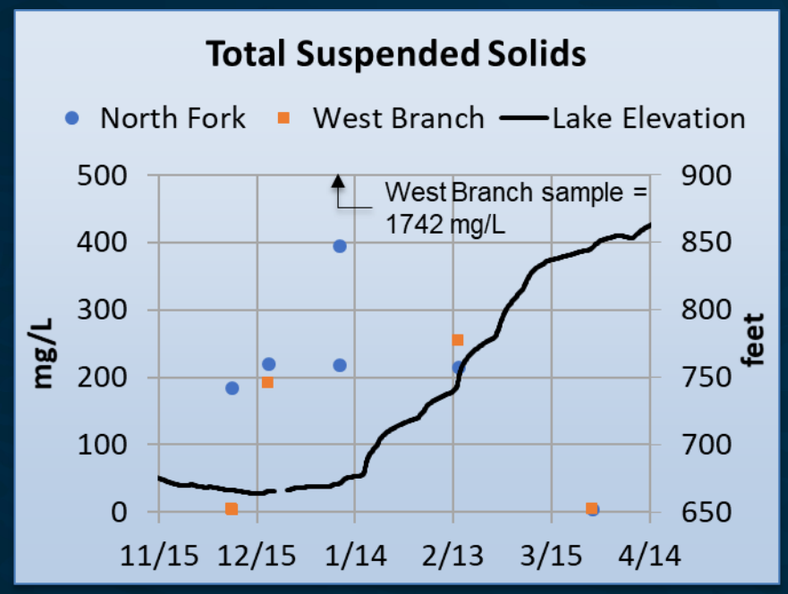
Analyte	Average RPD
D. Nitrate	78%
T. Phosphorus	188%
Total Suspended Solids	221%
Turbidity	327%

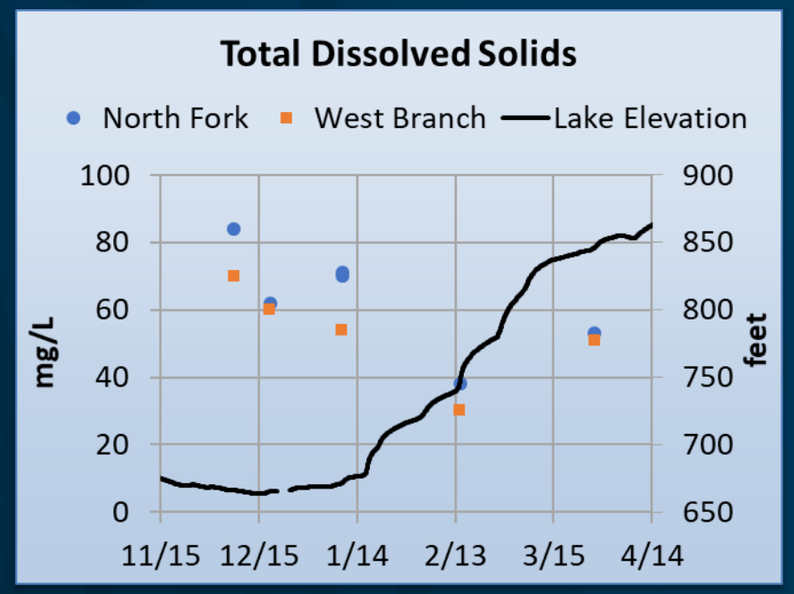
Some >MCL samples at both locations

+ Smaller increases and decreases for dissolved

Preliminary Lake Oroville Results

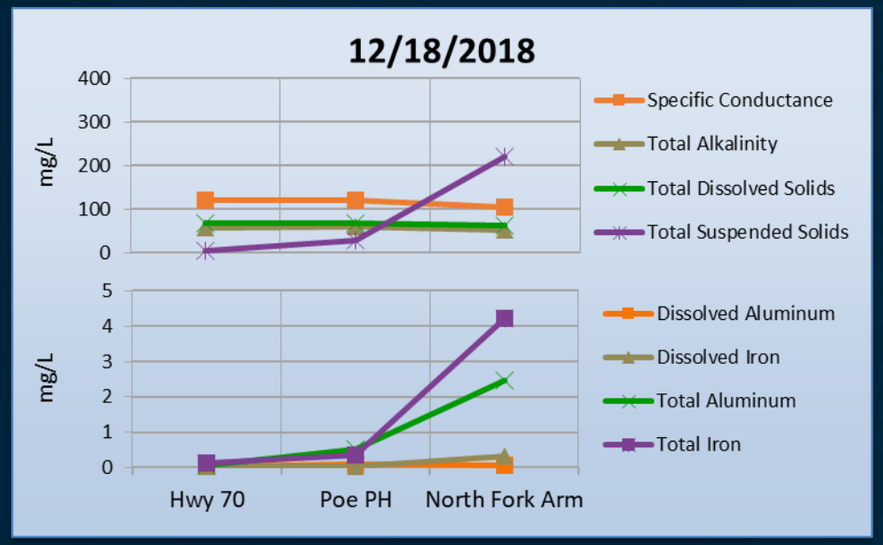






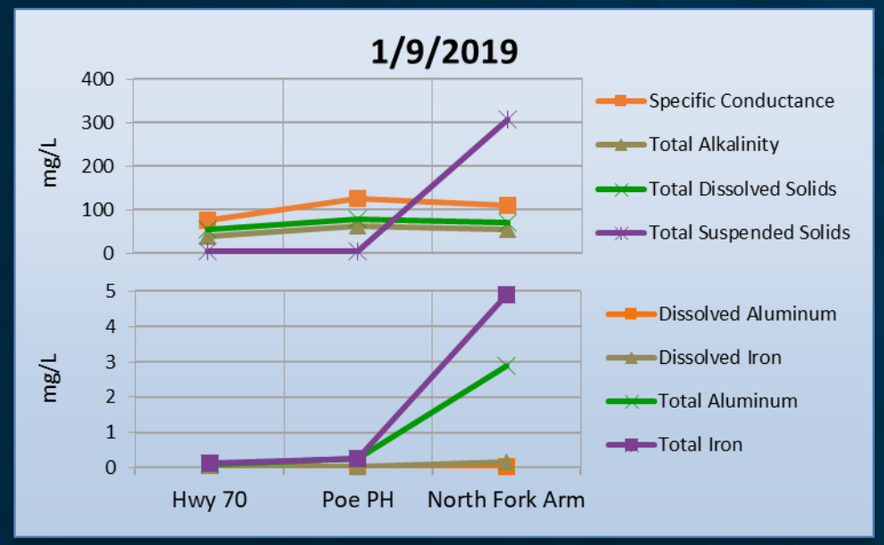
- Influenced by low lake levels and re-suspension of sediment already in the lake
  - High results for soil-related parameters observed:
    - When the lake was low (December and January)
    - When rainfall was high (January and February)
  - Lower concentrations for “totals” at higher lake levels.
- PAHs detected in March at both lake sites
  - No detections in other months or at other sites

Preliminary North Fork Longitudinal Sample Analysis



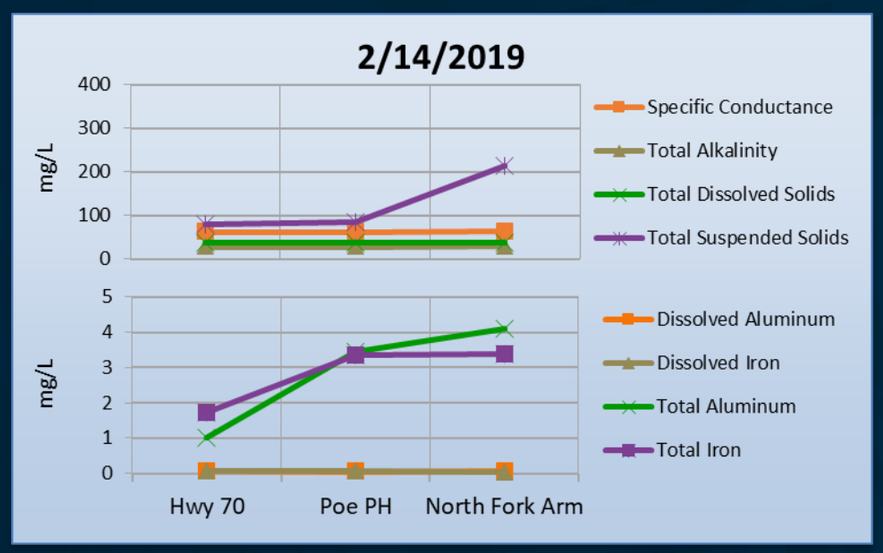
Lake Level: Low **Rain Total: Low**

- Minor or small increase between upstream and Poe
- Large increase in “Total” analytes in the lake



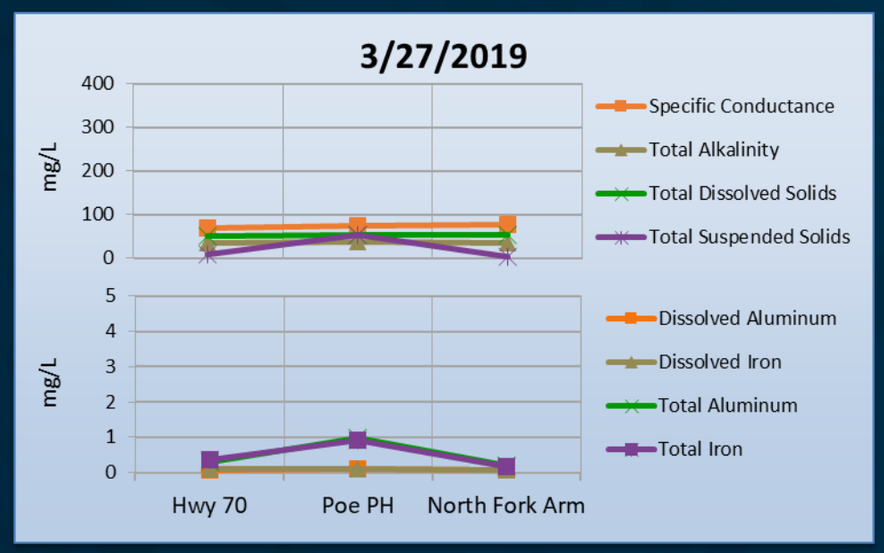
Lake Level: Low **Rain Total: Moderate**

- Minor or small increase between upstream and Poe
- Large increase in “Total” analytes in the lake



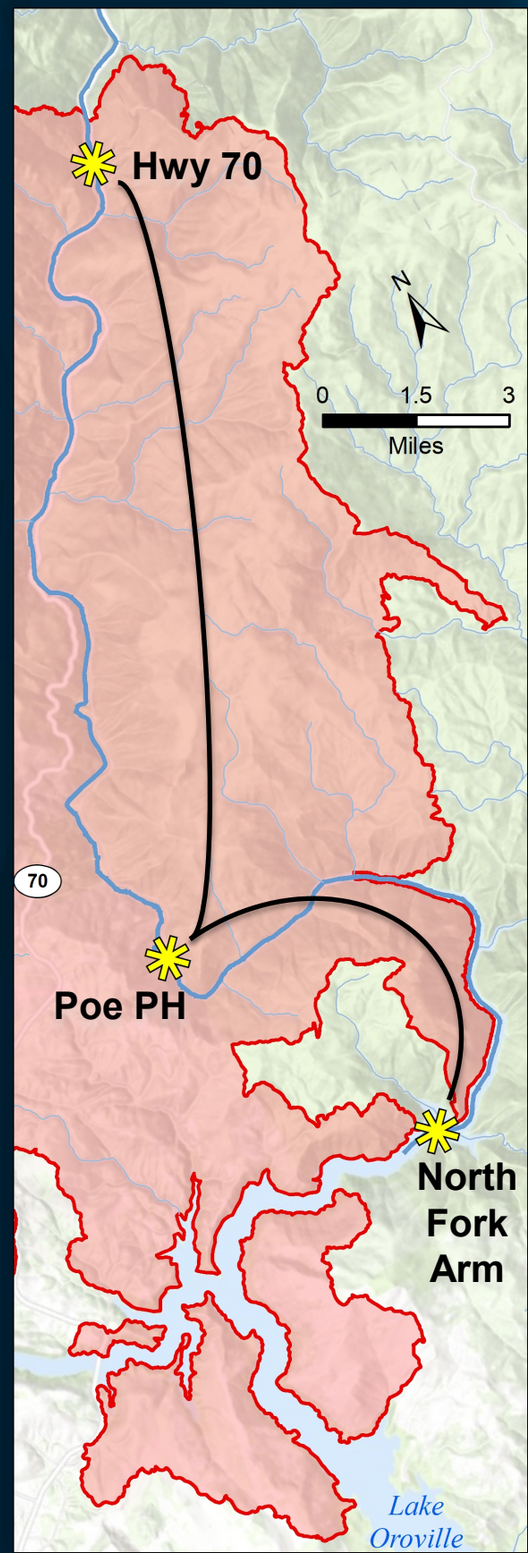
Lake Level: Moderate **Rain Total: Very High**

- Larger increase in “Totals” between upstream and Poe
- Large increase in TSS in the lake
- Minor to small increase in total metals and dissolved analytes between Poe and the lake



Lake Level: Very High **Rain Total: Moderate**

- Minor increase in TSS and total metals between upstream and Poe
- Minor or no increase other analytes
- Decrease in “Totals” between Poe and the lake

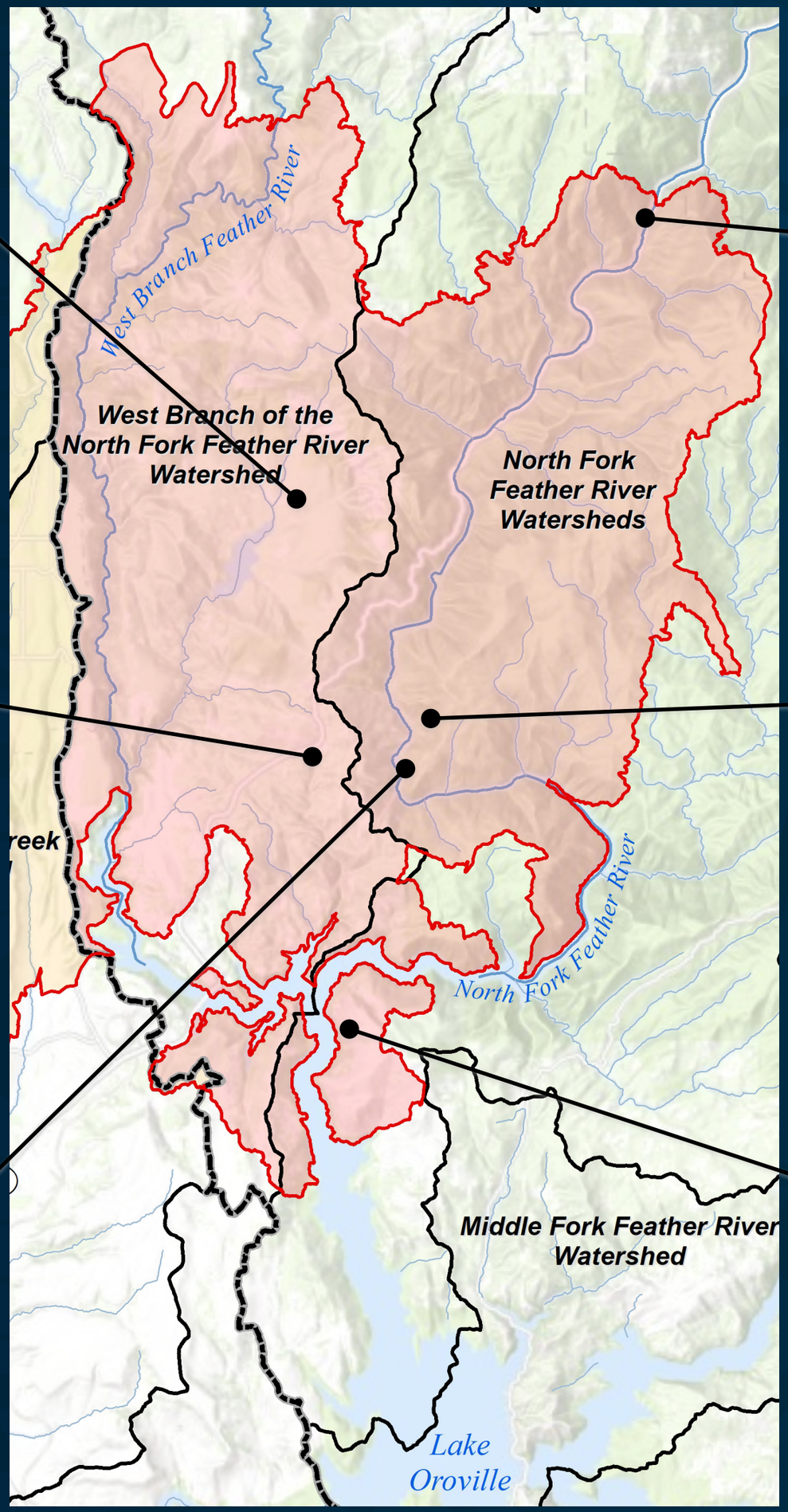


Preliminary Conclusions

- Likely a higher influx of concentrations for some analytes compared to those absent the fire
  - Especially solids, total metals, and nutrients
  - Primarily related to increased erosion
- More analysis needed for lake vs fire effects
  - Early lake samples were adversely affected by low lake levels (i.e., shallow depth at sample point)
  - Later samples showed increased dilution in the lake
- Effects to beneficial uses of Lake Oroville and the long term impacts need further analysis

Next Steps

- Finish assessing the late-2018 and early-2019 storm water effects on Lake Oroville
  - Incorporate pending May 2019 sample results
  - Further analyze re-sedimentation and dilution effects on lake samples
  - Possible post-rain season sampling in June
  - Evaluate long-term Lake Oroville sample data
- Based on final analysis and findings, determine if and/or how much further monitoring is needed next water year



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