Assessment of Camp Fire Impacts to Lake Oroville

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

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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

15-min. 24 mm/hr (large storm)

15-min. 40 mm/hr (very large storm)
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)
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)

* Rainfall data is based on an average of hourly rainfall at six stations in and around the fire boundary
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

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Average RPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. Aluminum #+</td>
<td>319%</td>
</tr>
<tr>
<td>T. Iron #+</td>
<td>124%</td>
</tr>
<tr>
<td>T. Manganese #+</td>
<td>138%</td>
</tr>
<tr>
<td>T. Nickel +</td>
<td>143%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Average RPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Nitrate</td>
<td>78%</td>
</tr>
<tr>
<td>T. Phosphorus</td>
<td>188%</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>221%</td>
</tr>
<tr>
<td>Turbidity</td>
<td>327%</td>
</tr>
</tbody>
</table>

# 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