

STATUS REPORT ON WATER QUALITY MONITORING

LEFT HAND WATERSHED CENTER

April 2020

Left Hand Watershed Center assesses water quality in Left Hand Creek Watershed, including two perennial tributaries: James Creek and Little James Creek. The purpose of this report is to present the latest monitoring data (2015 to 2020) on analytes of concern and discuss future actions. Currently, the Watershed Center monitors water quality at eight sites in relation to abandoned mines in the upper watershed and their impacts to water quality by acid mine drainage and metals contamination (Figure 1). The primary means by which the Watershed Center carries out water quality monitoring is through participation in the Colorado Department of Parks and Wildlife River Watch citizen monitoring program ([website](#)). In addition, this report includes supplementary data from the Watershed Center, Environmental Protection Agency (EPA), and Colorado Department of Public Health and Environment (CDPHE).

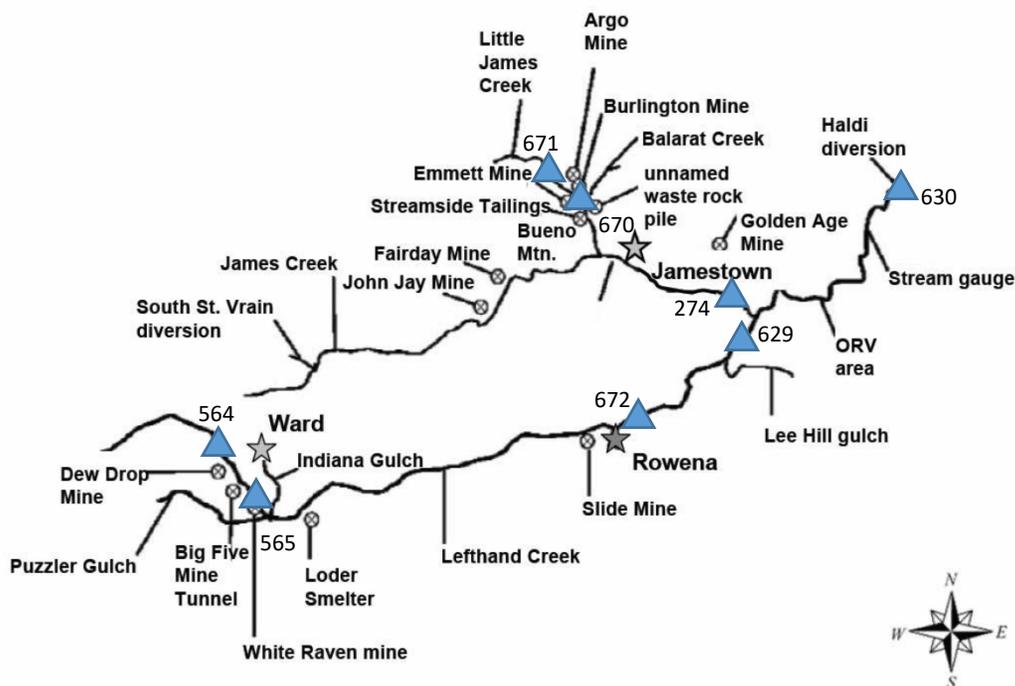


Figure 1. Left Hand Watershed Center's current River Watch sites in Left Hand Watershed (including Left Hand, James, and Little James Creeks). Site numbers linked to site names in Table 1.

In the upper reaches and tributaries of Left Hand creek, analytes of concern are outlined in Left Hand Creek Watershed's Total Maximum Daily Load (TMDL) Assessment (TMDL document [here](#)). The following analytes and dissolved constituents found to be in need of improvement in various reaches based on exceedances aquatic life standards are: Cadmium, Copper, Lead, Zinc and pH. At each site, we evaluated dissolved ambient concentrations for each analyte against chronic and acute aquatic life standards. Aquatic life standards are given for both chronic and acute conditions. Chronic standards are the most stringent and are designed to protect the majority (95%) of aquatic populations. Chronic standard exceedances may have adverse effects on growth, reproduction, and survival. Acute standards protect against outright mortality of 50% of the protected. At all sites, we compare all analytes of concern against the chronic aquatic life standards, however, acute exceedances also exist for certain

analytes depending on sample location. All metals standards are calculated using daily hardness, because the toxicity of metals to aquatic life decreases as hardness increases. For pH, the aquatic life standard range is 6.5- 9.0.

Within the past five years (period of record: 2015 to 2020), we found that upper Left Hand Creek and its tributaries continue to have occasional to consistent exceedances of the analytes of concern. In the tributaries, there were consistent exceedances of dissolved lead and pH at all sites (Table 1; Figure 4; Figure 6). One site in particular, site 670 Above Yellow Girl, had consistent exceedances of all dissolved metals and pH (Table 1; Figures 2-6). These results are consistent with our monitoring results dating back to 2008 (2016 Water Quality Report [here](#)).

Table 1. Summary table of exceedances of chronic aquatic life standards for all analytes at Left Hand Watershed Sites. Sites are described by creek name, site number, and site name. Frequency of exceedances (reported below as number of exceedance out of total number of samples per site) throughout the 2015 to 2020 period of record are listed for each site and by analyte. Single exceedances marked with an asterisk (*) indicate that the exceedance occurred after the Captain Jack Mine release.

Creek	Site No.	Site Name	Cadmium	Copper	Lead	Zinc	pH
Left Hand	564	Peak to Peak	1/28	4/28	4/28	0/28	9/32
Left Hand	565	California Gulch	23/32	32/32	6/32	26/32	28/36
Left Hand	672	Homeland	1/17*	8/17	0/17	1/17*	11/22
Left Hand	629	Above James Crk	1/30*	11/29	0/30	1/30*	23/34
Left Hand	630	Haldi Intake	2/34	7/34	2/34	1/34*	26/40
Little James	671	Upstream Burlington	3/26	4/26	18/26	1/26	22/31
Little James	670	Above Yellow Girl	34/35	34/35	33/35	34/35	38/39
James	274	Above Left Hand Crk	2/31	6/31	4/31	0/31	22/35

In Left Hand Creek, we found exceedances are dependent on location. Captain Jack Mine Superfund Site has impacted water quality in the upper reaches. Throughout the period of record, site 564 Peak to Peak (upstream of the mine) only occasionally exceeded chronic standards for Cadmium, Copper, Lead, and pH, while site 565 California Gulch (less than a mile downstream of the mine) consistently exceeded all chronic standards for all metals and pH, except for Lead. The remaining three sites downstream had fewer exceedances, and the majority were for Copper and pH (Table 1).

The most notable event during this period of record that impacted water quality in Left Hand Creek was an emergency mine water release, due to elevated in-mine water levels, at the Captain Jack Superfund Site in September 2018. Mine water effluent during this time was highly acidic and metals laden. Immediately after the release, our results showed exceedances of Cadmium, Copper, Zinc and pH at all sites downstream of the mine (Figures 7-13). At further downstream locations (excluding California Gulch), single Cadmium and Zinc exceedances were isolated to this event. Landowners also reported fish kill up to five miles downstream (including sites 565 and 672).

By late October 2018, an active treatment facility was installed at the mine adit to treat the mine water. During this time, we found pH levels increased at all sites downstream of the mine and consistently attained the aquatic life standard range at all sites downstream site 565 California Gulch (Figure 11). In December 2019, the active treatment facility was turned off after mine water had returned to historical elevations, and mine effluent is now passively treated by flowing through crushed limestone. Currently, we do not have the most recent River Watch data available to assess post- shutdown conditions. To fill in this data gap, we completed supplementary sampling at 565 California Gulch site and compiled some recent EPA monitoring data near this location. Using all three data sources, found that Zinc concentrations are exceeding aquatic chronic and acute thresholds. We also found that current concentrations exceed historic concentrations (prior to any remediation work in 2014). (Figure 14-15).

Abandoned mine drainage and its effects on the ecological condition and overall health of Left Hand Watershed remains an area of concern. In particular, we are concerned about the aquatic life in the upper reaches of Left Hand Creek. In addition to the fish kill, our Benthic Macroinvertebrate (BMI) results show impaired communities in both 2018 and 2019 samples (see 2020 State of the Watershed). In response to these findings, we have prioritized our collaboration with the agencies, EPA and CDPHE, in charge of the Superfund and Emergency Response Captain Jack projects. Collectively, we will closely monitor and evaluate future in-tunnel treatments by monitoring water quality of mine water effluent and downstream sites in Left Hand Creek.

Lastly, we also plan to extend our water quality monitoring efforts throughout the watershed. In both 2018 and 2019, we found BMI impairments in the lower watershed likely related to irrigation activities. In particular, we plan to monitor sites impacted by low flow and dry-up conditions during peak irrigation season.

Results

Little James Creek and James Creek

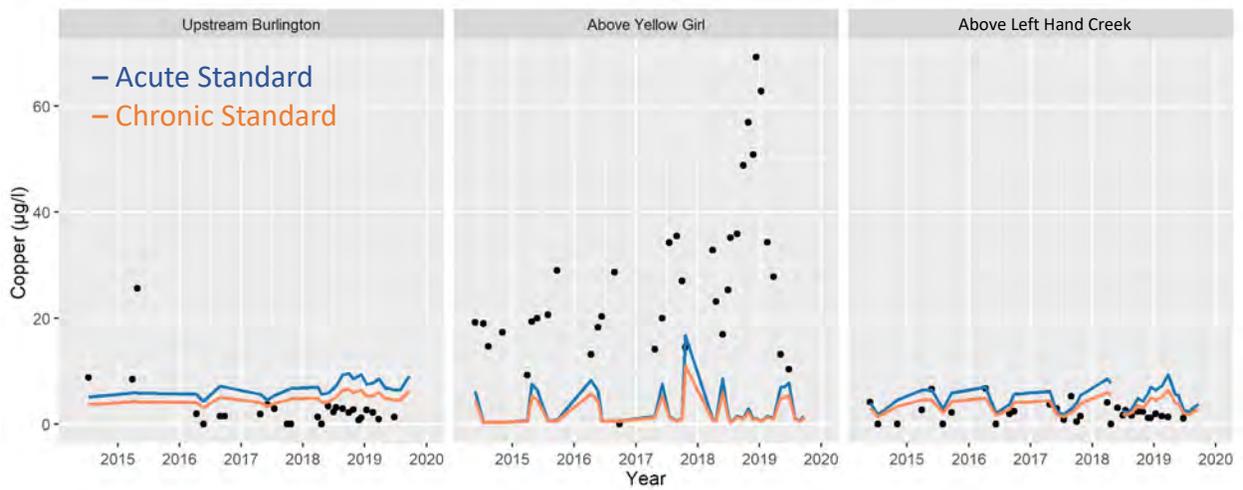


Figure 2. 2015 to 2020 dissolved Copper concentrations ($\mu\text{g/L}$) at Little James Creek (Upstream Burlington, Above Yellow Girl) and James Creek sites (Above Left Hand Creek). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively.

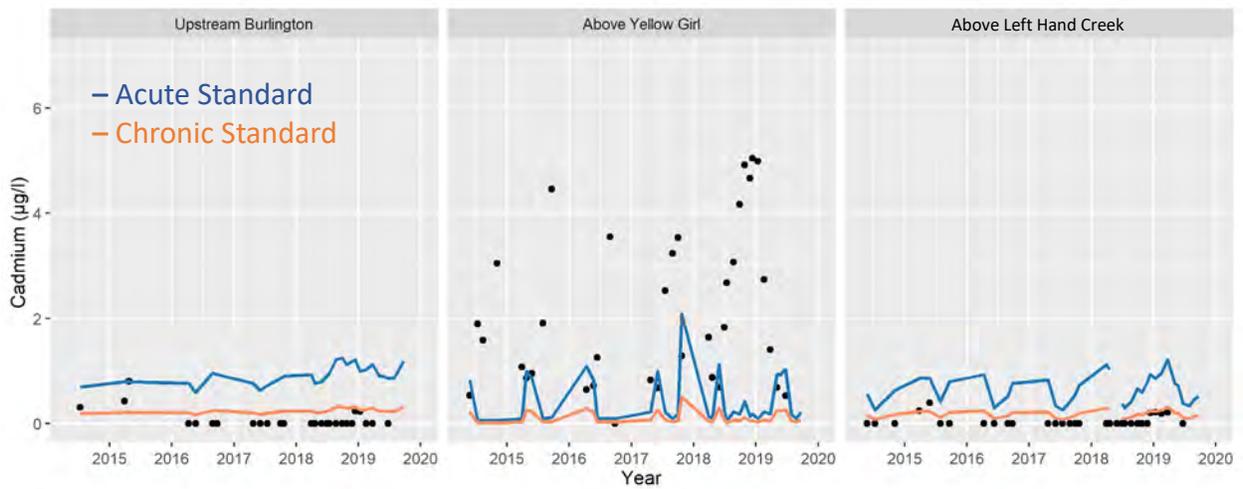


Figure 3. 2015 to 2020 dissolved Cadmium concentrations ($\mu\text{g/L}$) at Little James Creek (Upstream Burlington, Above Yellow Girl) and James Creek sites (Above Left Hand Creek). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances.

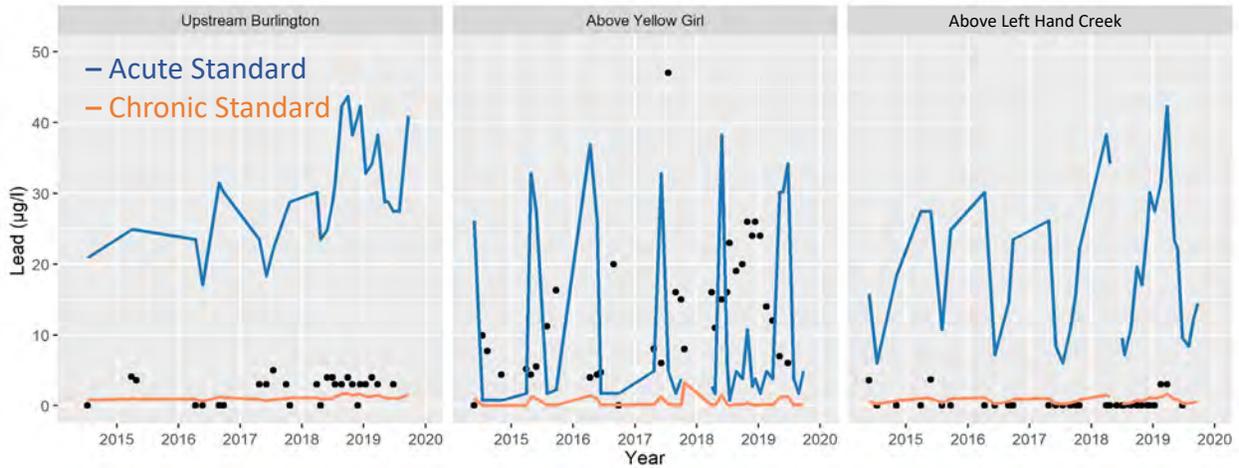


Figure 4. 2015 to 2020 dissolved Lead concentrations ($\mu\text{g/L}$) at Little James Creek (Upstream Burlington, Above Yellow Girl) and James Creek sites (Above Left Hand Creek). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances.

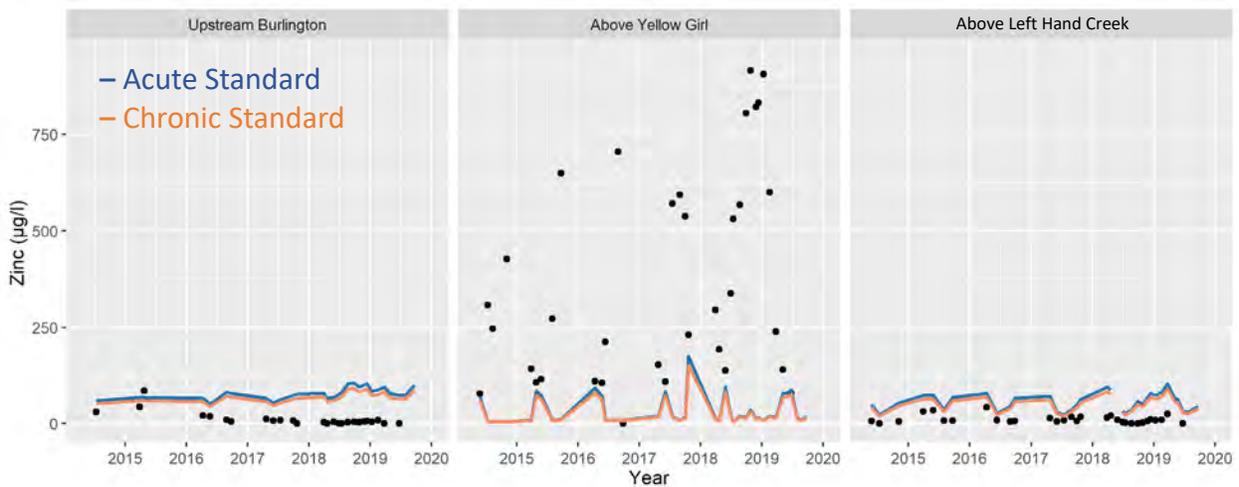


Figure 5. 2015 to 2020 dissolved Zinc concentrations ($\mu\text{g/L}$) at Little James Creek (Upstream Burlington, Above Yellow Girl) and James Creek sites (Above Left Hand Creek). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances.

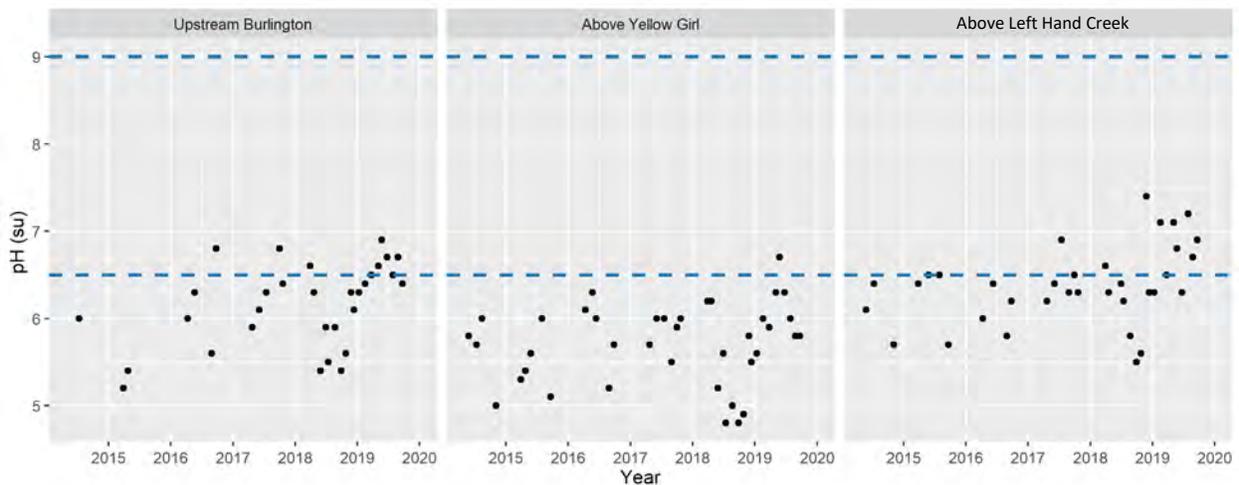


Figure 6. 2015 to 2020 pH (standard units) at Little James Creek (Upstream Burlington, Above Yellow Girl) and James Creek sites (Above Left Hand Creek). Blue dotted line shows aquatic life standard range 6.5- 9. Any values greater than 9 or less than 6.5 are exceedances.

Left Hand Creek



Figure 7. 2015 to 2020 dissolved Cadmium concentrations (ug/L) at Left Hand Creek sites (excluding California Gulch). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine.

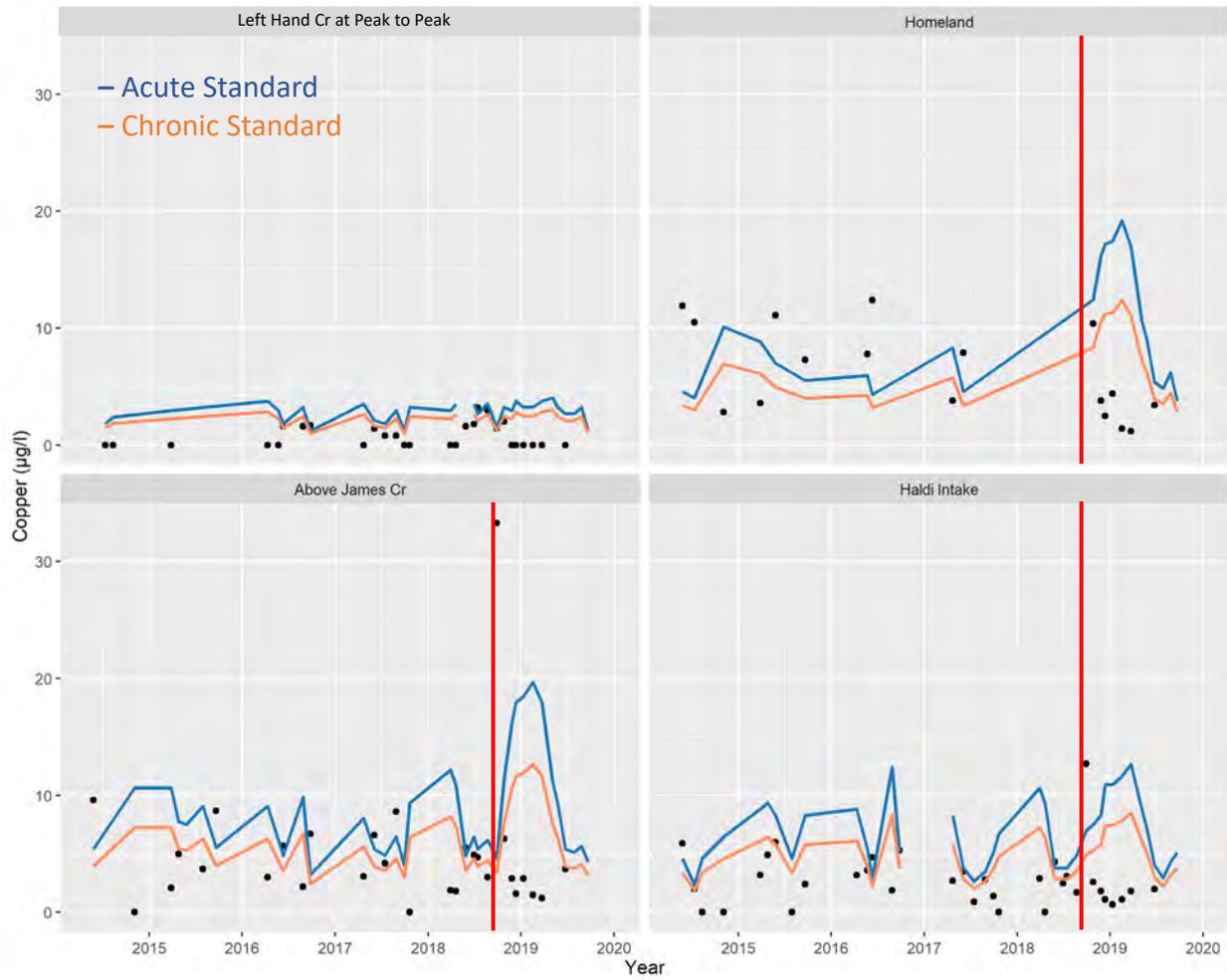


Figure 8. 2015 to 2020 dissolved Copper concentrations (ug/L) at Left Hand Creek sites (excluding California Gulch). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine.

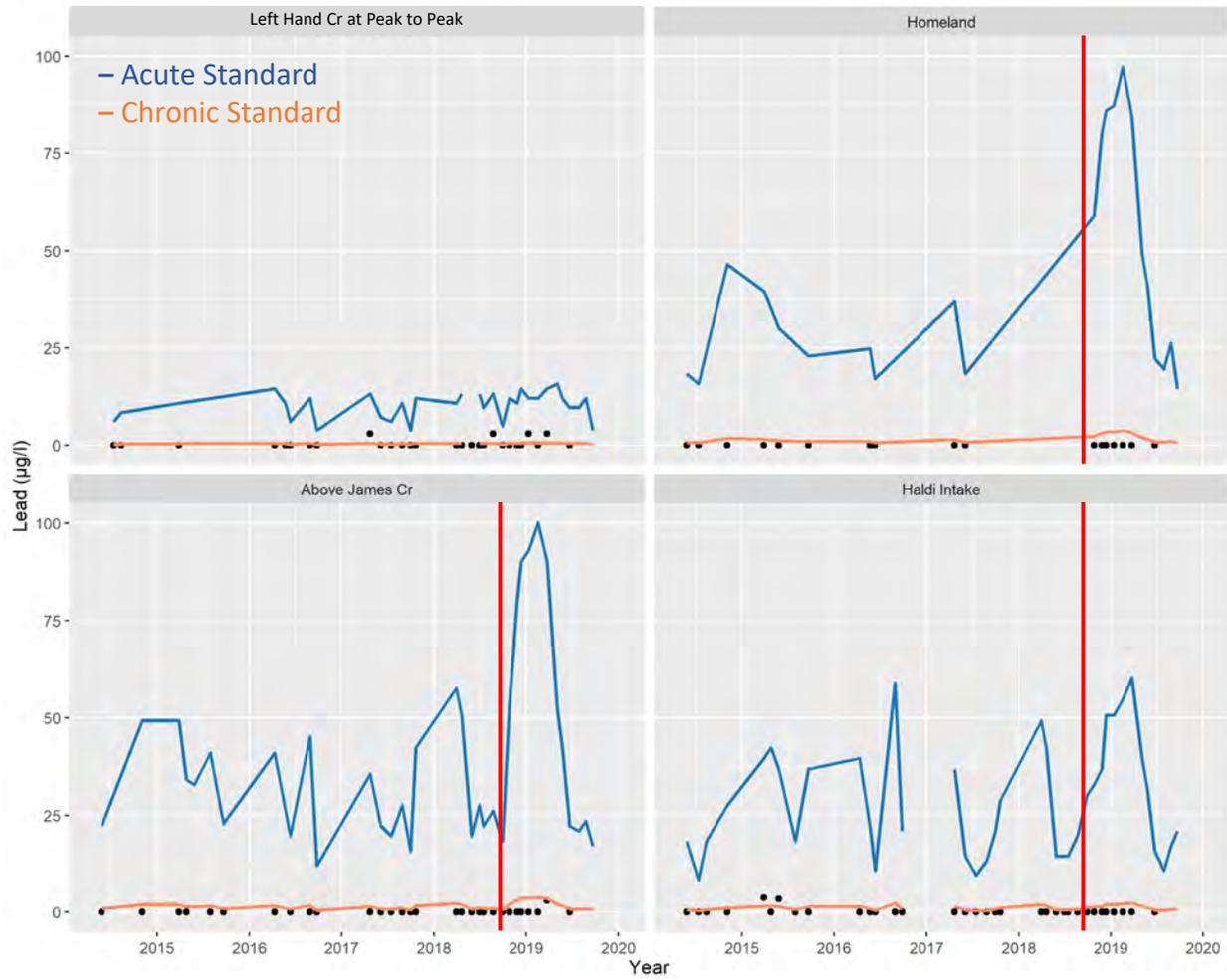


Figure 9. 2015 to 2020 dissolved Lead concentrations (ug/L) at Left Hand Creek sites (excluding California Gulch). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine.

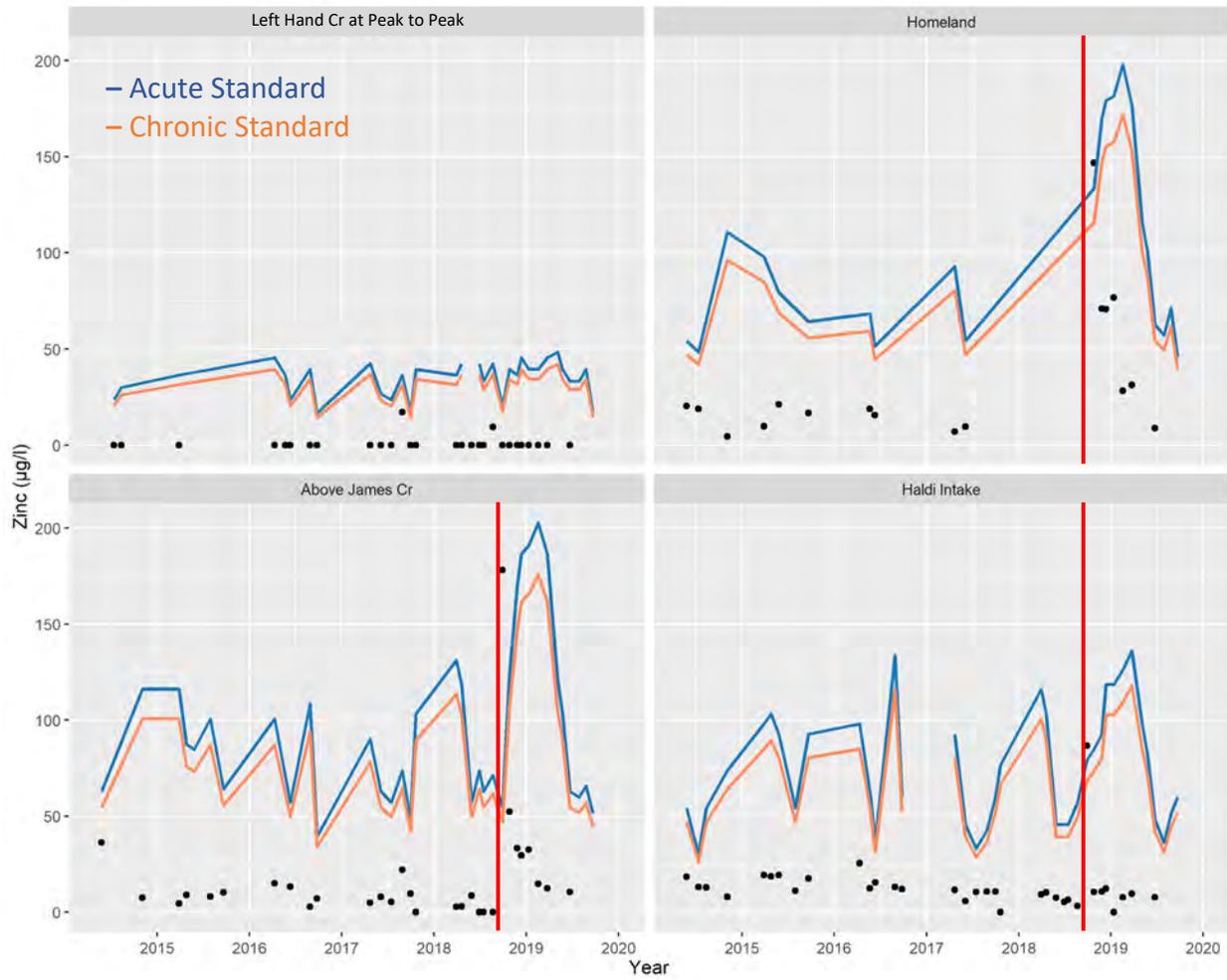


Figure 10. 2015 to 2020 dissolved Zinc concentrations (ug/L) at Left Hand Creek sites (excluding California Gulch). Hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. Concentrations greater than the chronic standard are exceedances. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine.

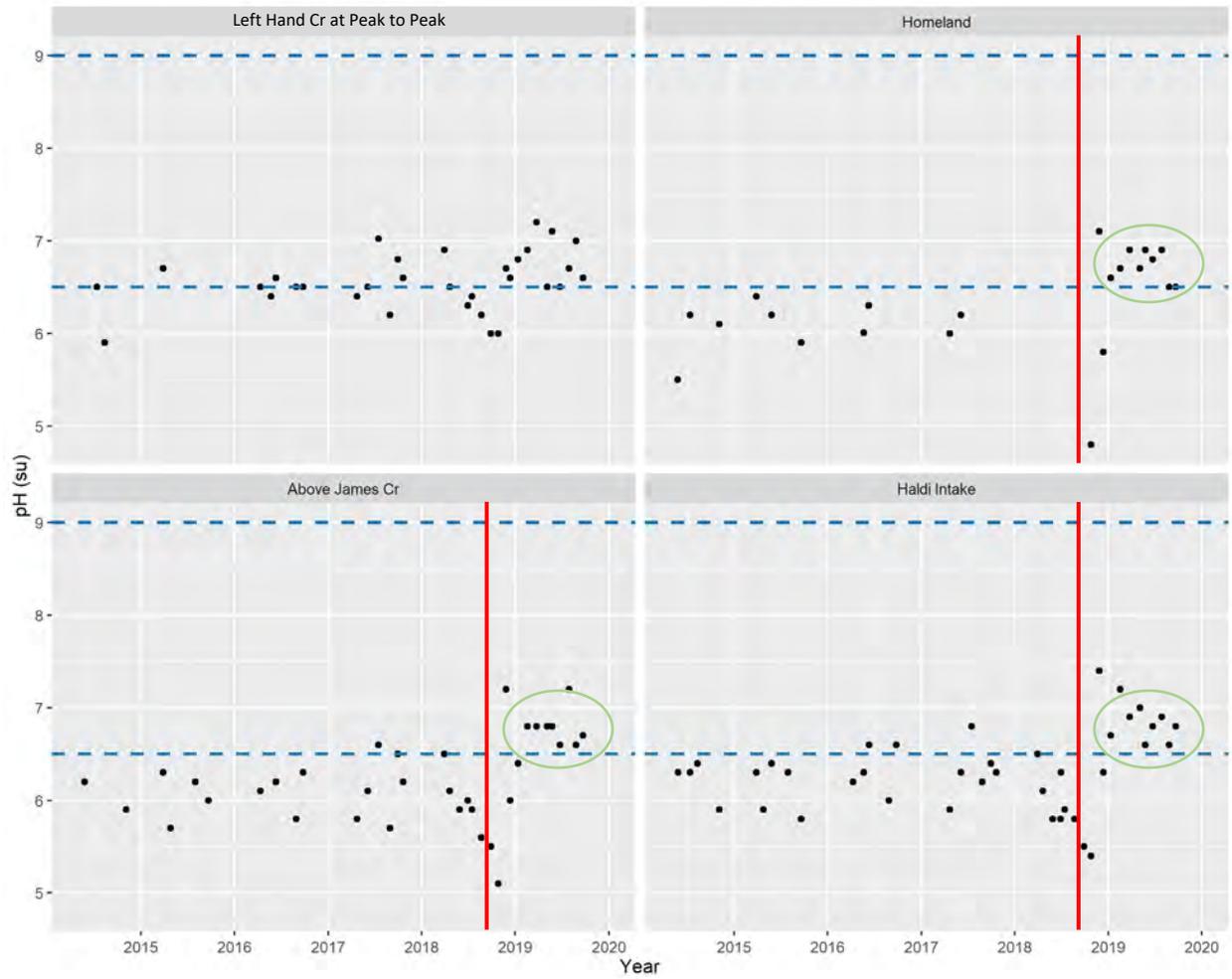


Figure 11. 2015 to 2020 pH at Left Hand Creek sites (excluding California Gulch). Blue dotted line shows aquatic life standard range 6.5- 9. Any values greater than 9 or less than 6.5 are exceedances. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine. Green circles highlight pH improvement since active treatment facility implementation.

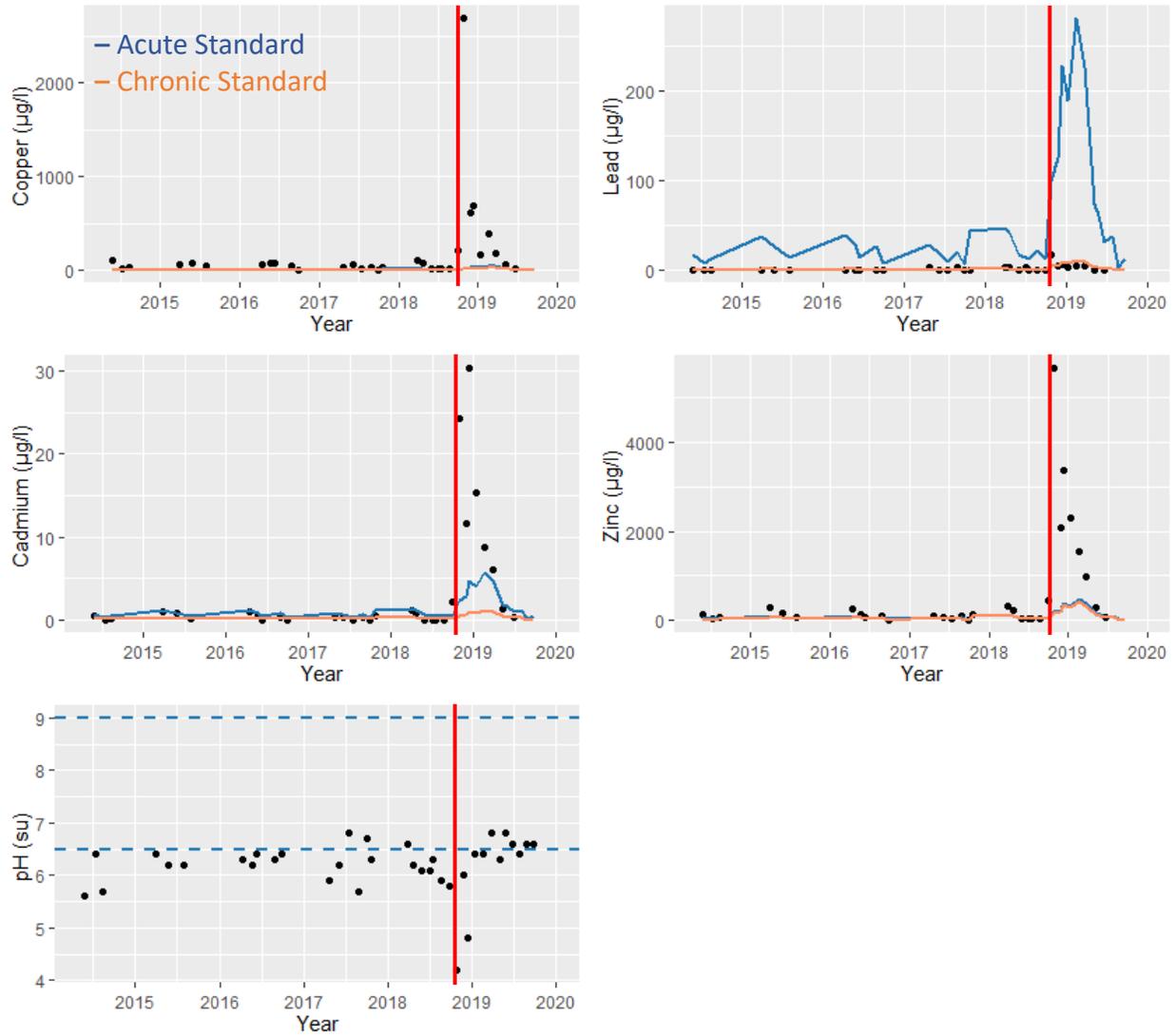


Figure 12. 2015 to 2020 dissolved Copper, Lead, Cadmium, and Zinc concentrations (ug/L) and pH at California Gulch on Left Hand Creek. Unmodified axes to show all results. For metals: hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. For pH: blue dotted line shows aquatic life standard range 6.5- 9. Red line highlights emergency release at Captain Jack Mine. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine.

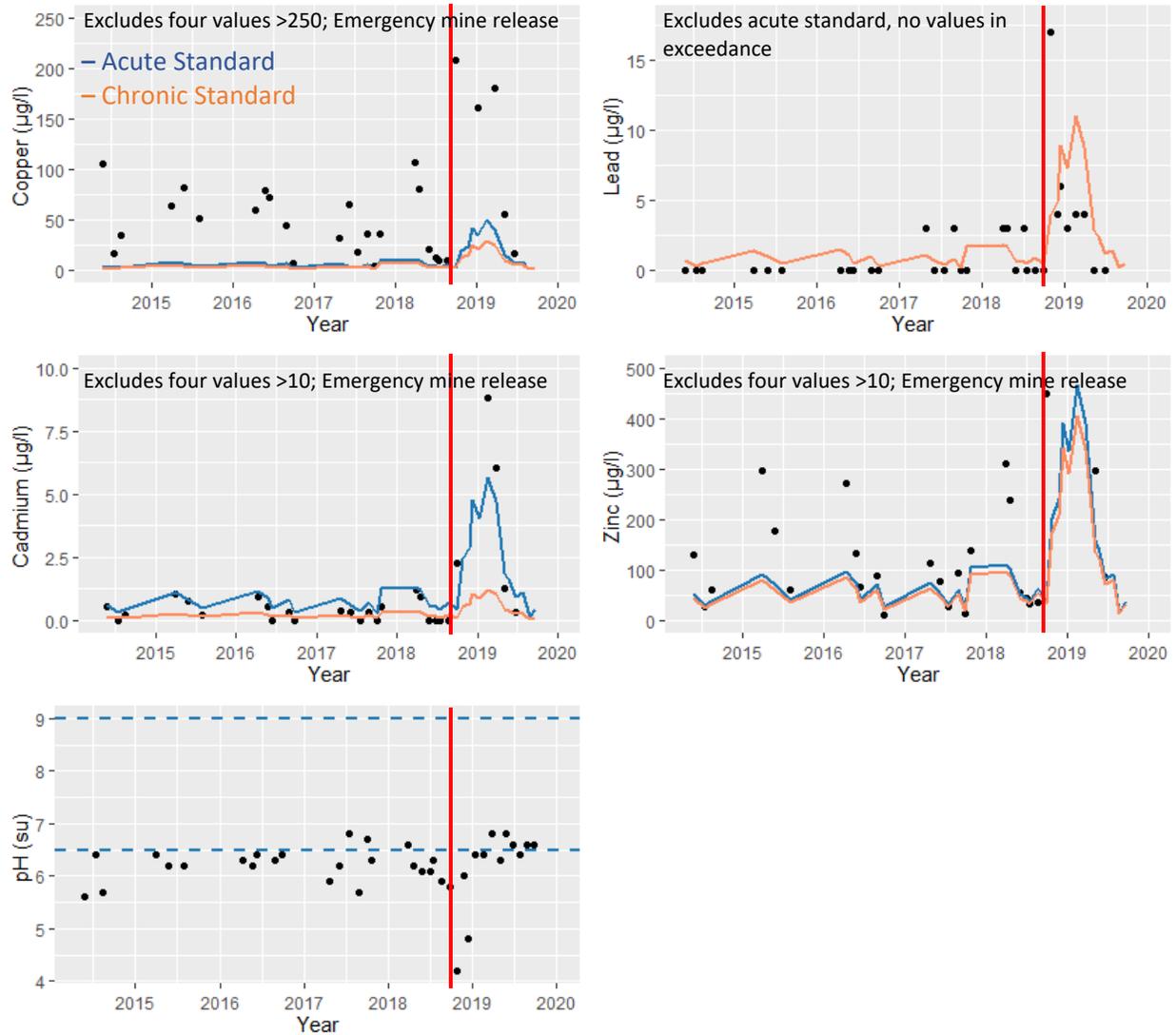


Figure 13. 2015 to 2020 dissolved Copper, Lead, Cadmium, and Zinc concentrations (ug/L) and pH at California Gulch on Left Hand Creek. Modified axes to show detail, any excluded values are noted on graph. For metals: hardness-based acute and chronic aquatic life standards shown in Blue and Orange, respectively. For pH: blue dotted line shows aquatic life standard range 6.5- 9. Red line highlights emergency release at Captain Jack Mine. Red line highlights emergency release at Captain Jack Mine for sites downstream of mine.

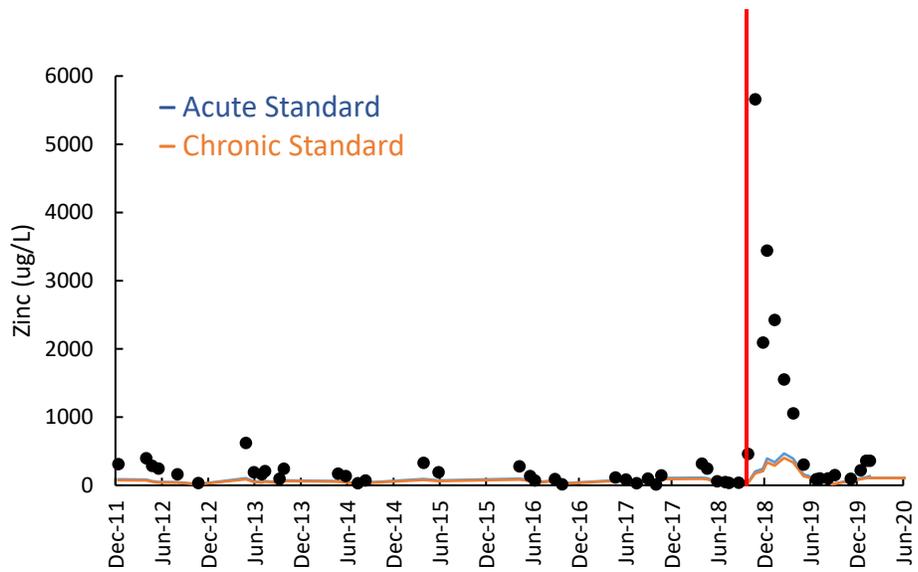


Figure 14. 2011 to 2020 dissolved Zinc concentrations (ug/L) at California Gulch on Left Hand Creek, including historical River Watch Data and most current data from Watershed Center and EPA. Unmodified axes to show all results. Hardness-based chronic and acute aquatic life standards shown in Orange and Blue, respectively. Red line highlights emergency release at Captain Jack Mine.

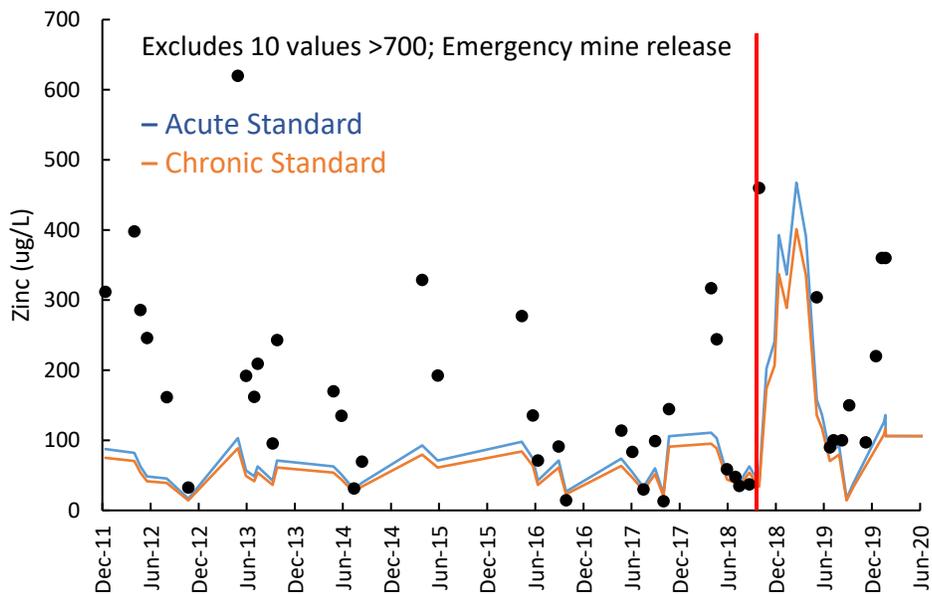


Figure 15. 2011 to 2020 dissolved Zinc concentrations (ug/L) at California Gulch on Left Hand Creek, including historical River Watch Data and most current data from Watershed Center and EPA. Modified axes to show detail, any excluded values are noted on graph. Hardness-based chronic and acute aquatic life standards shown in Orange and Blue, respectively. Red line highlights emergency release at Captain Jack Mine.