Coeur d'Alene Basin Environmental Monitoring Program - Surface Water

Annual Data Summary – Water Year 2022

Photograph: South Fork Coeur d'Alene River near Pinehurst, ID, USGS site number 12413470, January 2022. Photographs by Nick Korzen, USGS.

Coeur d'Alene Basin Environmental Monitoring Program - Surface Water

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Overview

The United States Geological Survey (USGS) operates and maintains 11 real-time stream gaging sites and collects surface water-quality samples two to six times annually at 20 monitoring sites (Figure 1) in the Spokane and Coeur d'Alene River basins (Clark and Perreault, 2017). This work is conducted in cooperation with the United States Environmental Protection Agency (EPA) to support the Coeur d'Alene Basin Environmental Monitoring Program (BEMP) (U.S. Environmental Protection Agency, 2002; 2012).

The Coeur d'Alene River extends across Idaho from the Montana border on the east to the Washington border on the west. Streams within the basin have been extensively affected by historic mining activities and are subject to ongoing remedial actions. The Coeur d'Alene River basin is mountainous, with elevations ranging from 2,000 to 6,850 feet above sea level. About 70 percent of the annual precipitation falls as snow during the winter (October through April), and the highest streamflows and metal loads normally occur during spring runoff. However, warm winter Pacific storms can affect the area, bringing heavy rains and warm temperatures that can cause rapid snowmelt and produce high streamflow rain-on-snow events. These events can be associated with high transport of sediment and sediment-bound trace metals. In contrast, the lowest streamflows and highest dissolved metal concentrations typically occur during September and October (Clark and Mebane, 2014).

Selected streamflow and water-quality results from the water year 2022 surface water BEMP are presented herein. Additional water-quality and streamflow data are available in the USGS National Water Information System database, http://waterdata.usgs.gov/nwis (U.S. Geological Survey, 2023), and in the Excel workbooks provided with this summary.

Highlights from water year 2022 include the following:

- Streamgaging at 11 real-time sites occurred year-round as planned.
- Water year 2022 streamflows overall were higher than median conditions. Peak streamflows occurred during May and June, and the peak streamflows were higher in magnitude and later in timing than median peak streamflows.
- Water-quality sampling events occurred as planned during a late fall storm in November (16 sites), winter low flows in January (6 sites), a rain-on-snow event in March (16 sites), spring snowmelt runoff in May (20 sites), runoff recession in July (6 sites), and baseflow conditions in September (20 sites).
- Comparisons between water year 2022 and 2012-2021 concentrations showed similar or lower total lead, dissolved zinc, and dissolved cadmium concentrations in water year 2022 relative to the previous ten years at most mining-affected sites.
- For select sites where mercury samples were collected, mercury concentrations were highest during the March rain-on-snow event, with most mercury occurring in the unfiltered total fraction.
- The USGS completed the post-remedy seepage study on the South Fork Coeur d'Alene River between Kellogg and Smelterville on August 29-31.

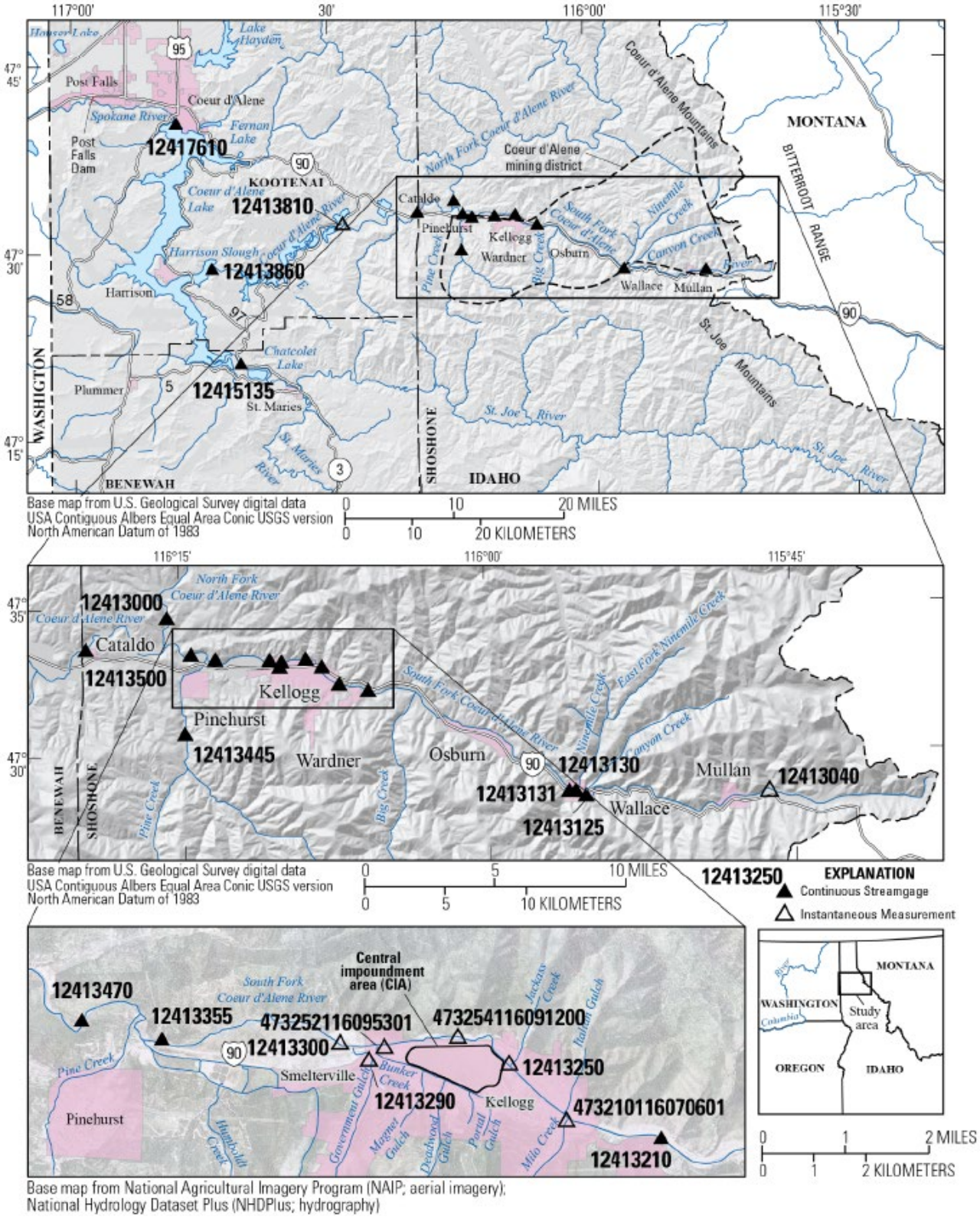

Figure 1. Sampling sites in the Coeur d'Alene and Spokane River Basins.

Observations

Water year 2022 was characterized by streamflows that were generally higher than median conditions. Figure 2 shows daily median streamflow for the streamflow period of record and water year 2022 daily mean streamflow at continuously gaged sites in the basin. A rain-on-snow event in early March caused a streamflow peak in most of the basin, with a daily mean peak of 18,000 cfs in the Coeur d'Alene River near Harrison. Spring snowmelt runoff in 2022 was prolonged and the peak was generally higher and later than median spring runoff. Summer and fall baseflows throughout the basin were somewhat later and higher than median baseflows (Figure 2).

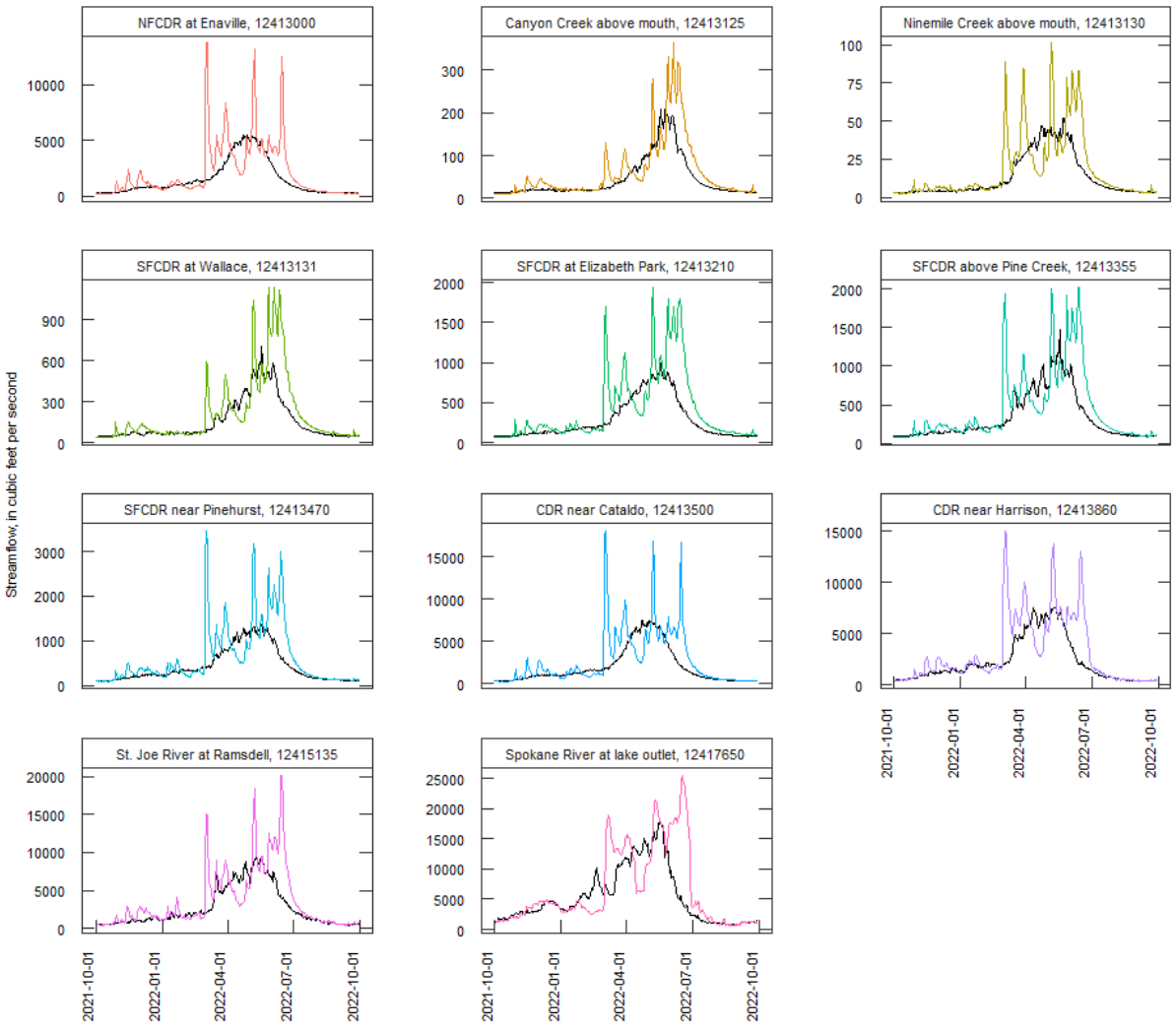

Figure 2. Water year 2022 streamflow at BEMP sites with continuous gaging. Colored lines show water year 2022 daily mean streamflow. Black lines show the median daily streamflow for the available streamflow period of record, which varies by site. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River. Note the vertical axis scale varies by plot.

Water-quality sampling events occurred as planned during a late fall storm in November (16 sites), winter low flows in January (6 sites), a rain-on-snow event in March (16 sites), spring snowmelt runoff in May (20 sites), runoff recession in July (6 sites), and baseflow conditions in September (20 sites). The March, May, September, and November sampling events were completed as part of the strategy for

basin-wide monitoring across a variety of hydrologic conditions. The January and July events were completed as part of the strategy for monitoring remedy-effectiveness associated with the recently completed groundwater collection system at the Central Impoundment Area (CH2M, 2018).

Figures 3 through 5 show selected water year 2022 water-quality results (total lead, dissolved zinc, and cadmium concentrations) visually compared to results from the previous ten years (2012-2021). Based on visual comparison, median total lead concentrations at most sites in water year 2022 were lower than or similar to 2012-2021 medians (Figure 3). However, several sites (NFCDR at Enaville, CDR near Cataldo, and seeps north of tailings) had higher median concentrations in water year 2022 than during the previous ten years (Figure 3).

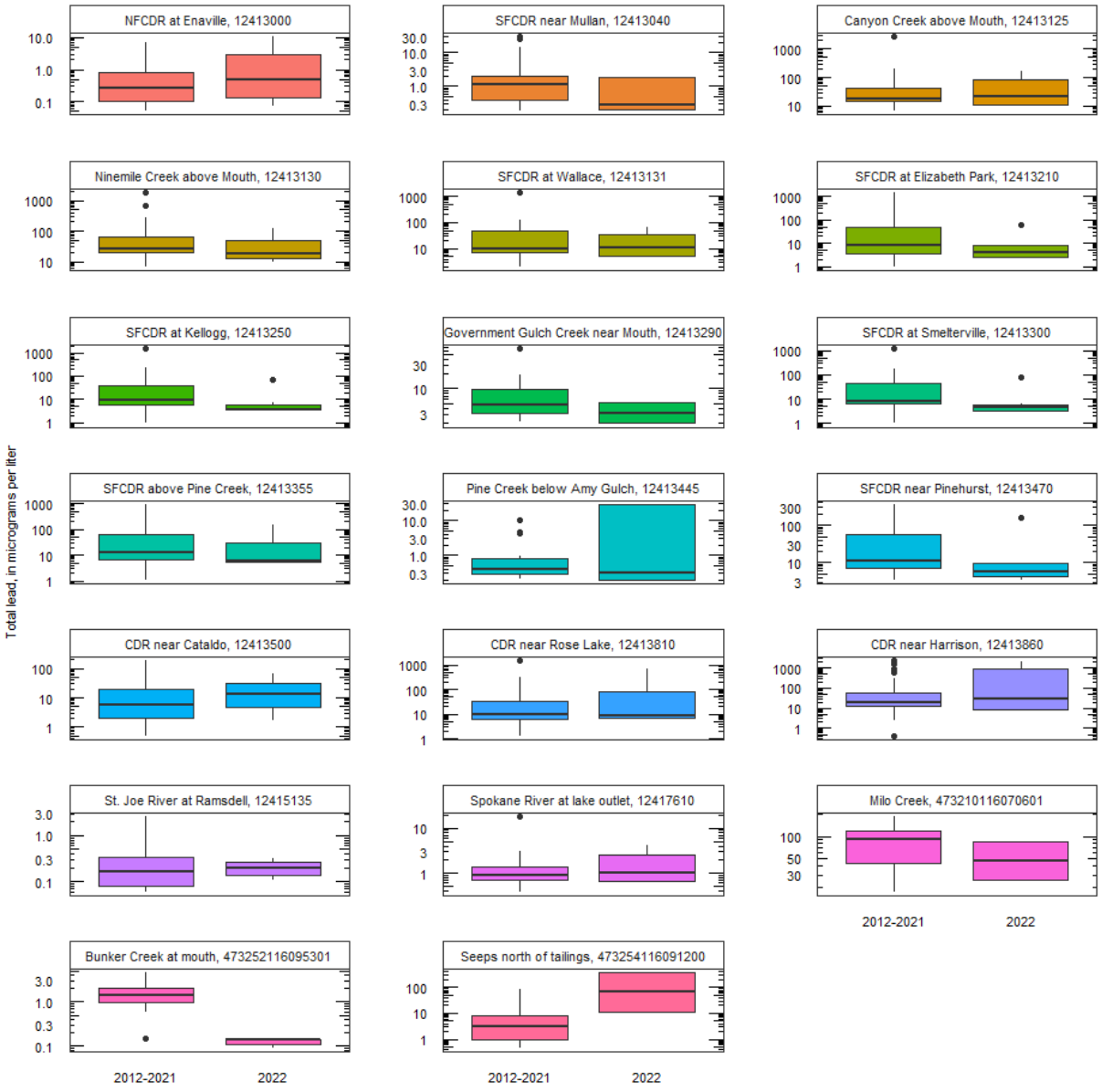

Figure 3. Total lead concentrations at BEMP sites in water year 2022 versus 2012-2021. Note the vertical axis scale is logarithmic and varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

Based on visual comparison, median dissolved zinc concentrations at most sites in water year 2022 were similar to or lower than 2012-2021 medians (Figure 4). In particular, sites in the mainstem Coeur d'Alene and Spokane Rivers had lower medians than in the preceding ten years. However, at Bunker Creek, the median dissolved zinc concentration in water year 2022 was higher than in the previous ten years. At most sites, the range of 2022 concentrations was also narrower than in the preceding ten years, consistent with the expectation that the range in any one year would be narrower than the range for ten years (Figure 4).

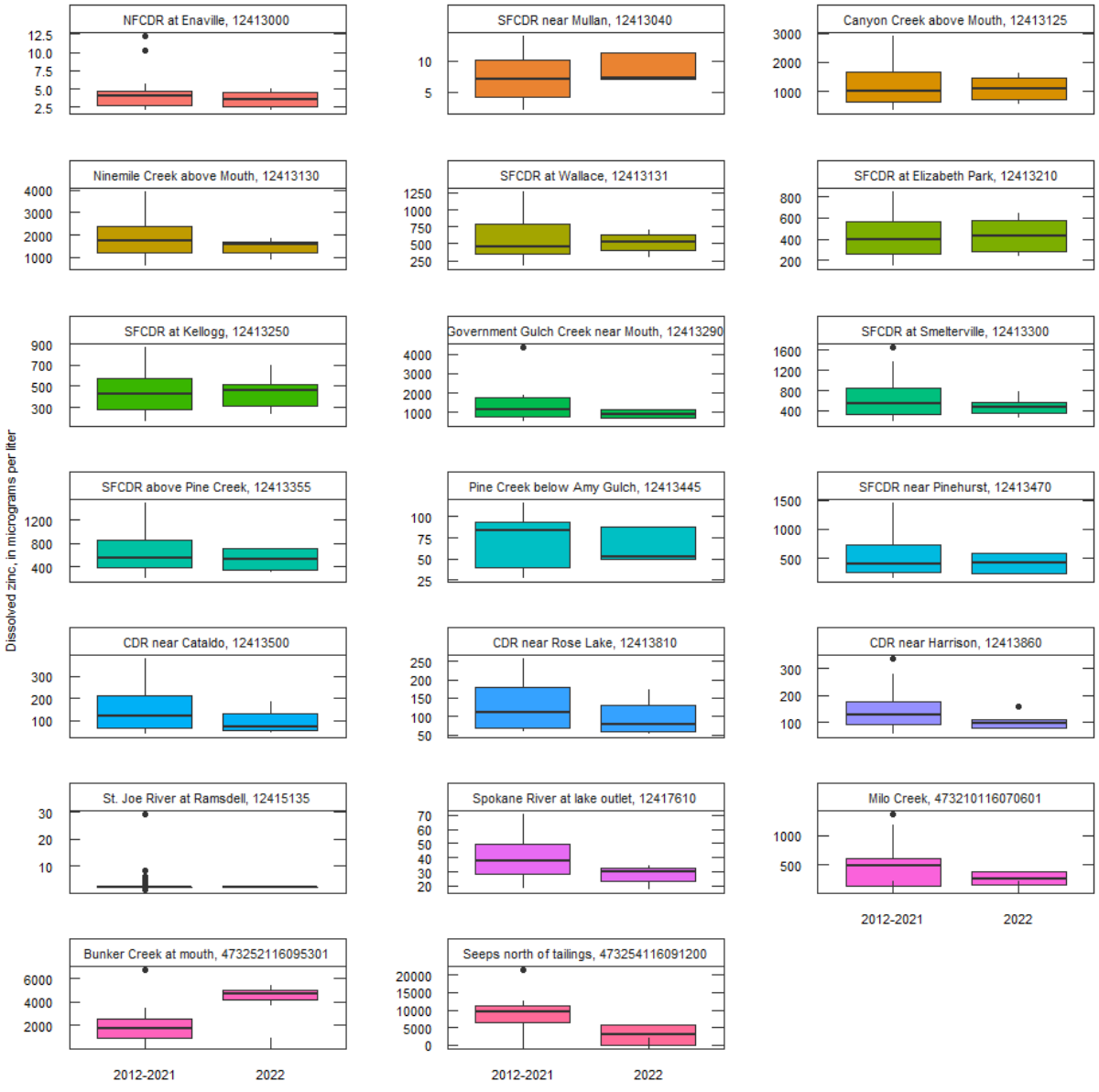

Figure 4. Dissolved zinc concentrations at BEMP sites in water year 2022 versus 2012-2021. Note the vertical axis scale varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

Based on visual comparison, median dissolved cadmium concentrations at most sites in water year 2022 were lower than or similar to 2012-2021 median concentrations (Figure 5). In particular, sites in the mainstem Coeur d'Alene and Spokane Rivers had lower medians than in the preceding ten years. However, the median dissolved cadmium concentration in Bunker Creek was higher in water year 2021 than in the preceding ten years. At every site, the range of 2021 concentrations was also narrower than in the preceding ten years, consistent with the expectation that the range in any one year would be narrower than the range for ten years (Figure 5).

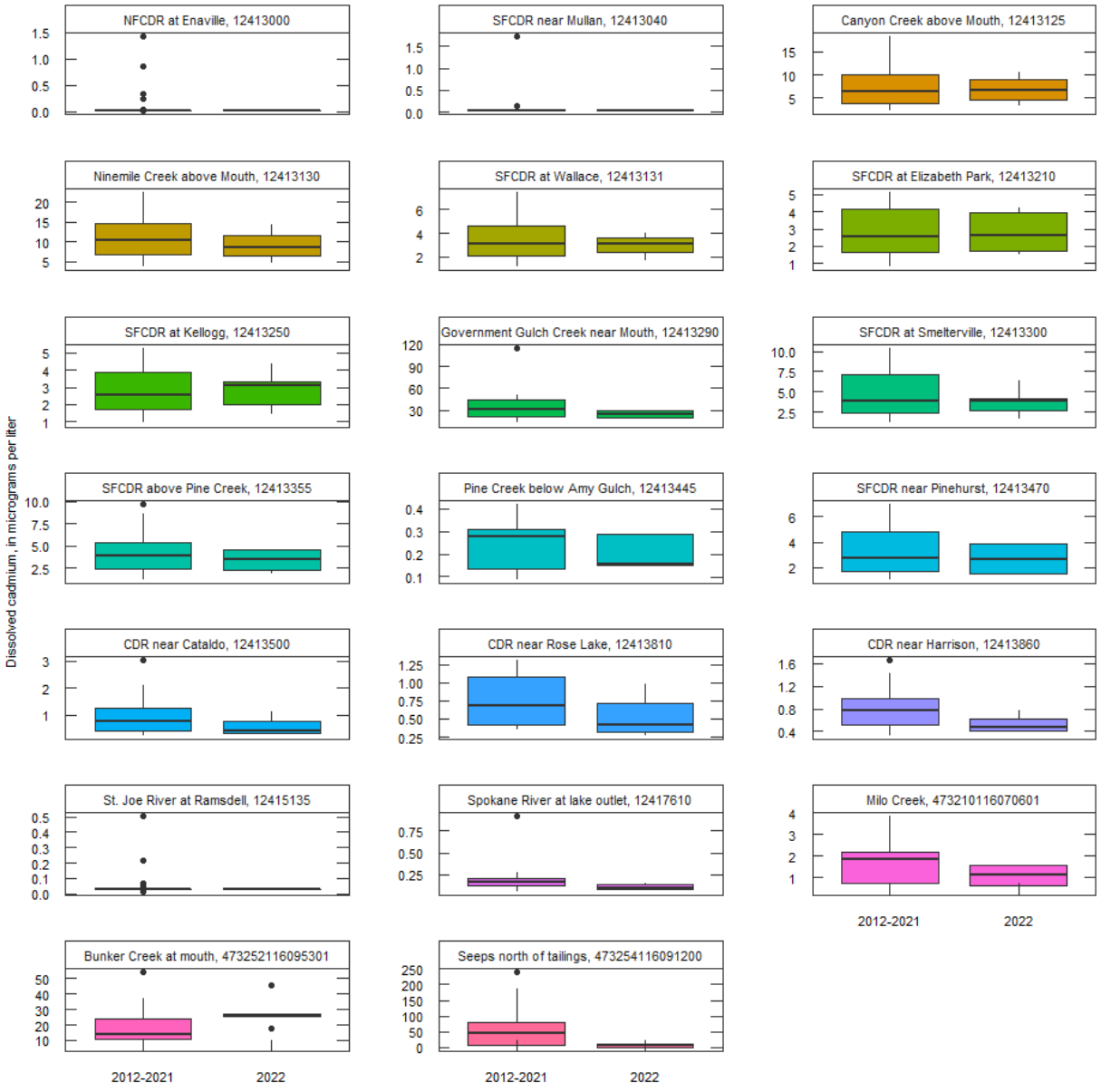

Figure 5. Dissolved cadmium concentrations at BEMP sites in water year 2022 versus 2012-2021. Note the vertical axis scale varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

In water year 2022, the USGS collected samples for total mercury analysis at a subset of sites during a subset of events. The goal was to gain an understanding of mercury concentrations in streamflow; results are shown in Figure 6. Overall, the highest concentrations of mercury at all sites occurred during the March rain-on-snow event, and the majority of the mercury is present in the unfiltered fraction.

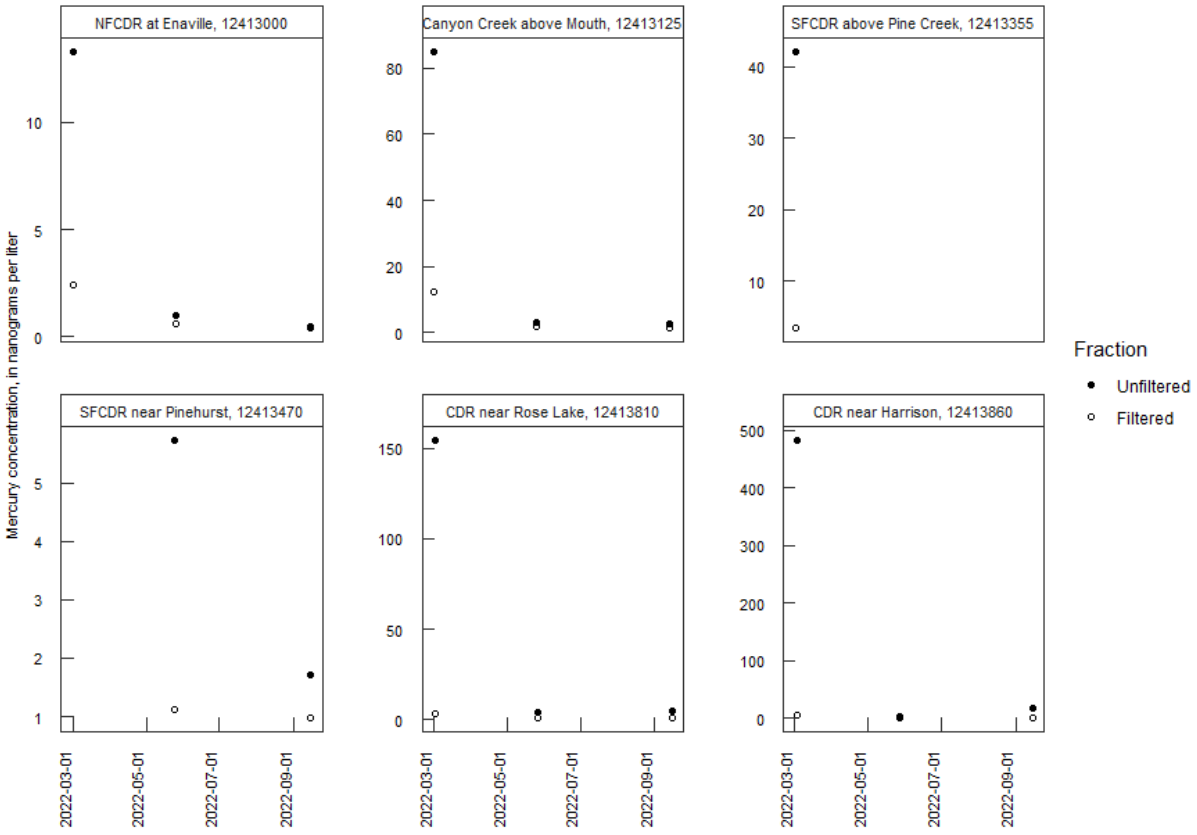

Figure 6. Unfiltered and filtered total mercury concentrations at select BEMP sites, water year 2022. Note the vertical axis scale varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

For a subset of sites and events in water year 2022, the USGS also collected samples to analyze for the constituents associated with the State of Idaho copper criteria biotic ligand model. These expanded constituents included sodium, potassium, chloride, sulfate, dissolved organic carbon, and alkalinity. Due to problems at the USGS National Water Quality Laboratory, eight alkalinity samples were lost, and analyses for eight more samples are still pending; copper criteria have therefore not been calculated at this time but will be in the future when alkalinity results are available.

The USGS completed the post-remedy seepage study on the South Fork Coeur d'Alene River between Kellogg and Smelterville on August 29-31, 2022. Discharge measurements and samples were collected at four river sites, two tributary sites, and three seep sites; samples were analyzed for trace metals and nutrients. The results of the 2022 study, with a comparison to the results of the 2017 pre-remedy seepage study, will be published in a USGS Scientific Investigations Report by December 31, 2023.

Quality Control Samples

Twelve replicate samples and fourteen blank samples were collected in water year 2022. Most analytical results were in good agreement (relative percent difference less than 20 percent) between replicate pairs. Several samples had higher (20-30) relative percent differences between replicate pairs for orthophosphate, total nitrogen, total iron, filtered mercury, filtered and unfiltered arsenic, and dissolved organic carbon. One replicate pair had a relative percent difference of 39 percent for unfiltered manganese, albeit at low concentrations (0.81 µg/L versus 1.2 µg/L). Another replicate pair had a relative percent difference of 46 percent for unfiltered total mercury, albeit also at low concentrations (2.72 ng/L versus 4.34 ng/L).

In the blank samples, most constituents were not detected. However, there was one low concentration detection each of calcium, magnesium, nitrate, filtered and unfiltered copper, unfiltered lead, and filtered mercury. There were two low concentration detections each of filtered lead and unfiltered zinc. Given the multiple blank detections, equipment cleaning procedures will be reviewed with field staff and blank performance will continue to be monitored in water year 2023, with procedures revised as necessary.

References

CH2M, 2018, Draft Final Operable Unit 2 Groundwater Collection System Remedial Action Effectiveness Monitoring Plan, Bunker Hill Mining and Metallurgical Complex Superfund Site, Prepared for U.S. Environmental Protection Agency, Region 10. 118 p.

Clark, G.M., and Mebane, C.A., 2014, Sources, transport, and trends for selected trace metals and nutrients in the Coeur d'Alene and Spokane River Basins, Idaho, 1990-2013: Reston, VA, 2014-5204. 74 p, at http://pubs.er.usgs.gov/publication/sir20145204.

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