

**STATUS REPORT ON WATER QUALITY MONITORING  
LEFTHAND WATERSHED OVERSIGHT GROUP  
February 2016**

**Introduction**

Part of the mission of the Lefthand Watershed Oversight Group (LWOG) is to assess the quality of the Left Hand Creek Watershed, including its perennial tributaries, James Creek and Little James Creek. A primary factor that led to the founding of LWOG in 2003 was concern regarding impacts of acid mine drainage and metals contamination from abandoned mining sites in the mountainous part of the watershed. The primary means by which LWOG carries out this part of its mission is through participation in the Colorado Department of Parks and Wildlife River Watch citizen volunteer monitoring program (<http://cpw.state.co.us/aboutus/Pages/RiverWatch.aspx>, <http://www.coloradoriverwatch.org/>). The River Watch program provides training, quality assurance, supplies and equipment for sampling and selected analyses, and analytical services for metals.

In addition to River Watch sampling, LWOG takes occasional samples at the Rowena Spring along Left Hand Creek, for bacteria, and at 81<sup>st</sup> Street, for hardness.

**Total Maximum Daily Load Assessment of Left Hand Creek Watershed**

In 2015 The Colorado Department of Public Health and Environment developed a TMDL assessment for the Left Hand Creek Watershed. The TMDL was based partly on River Watch data and partly on data collected by others. LWOG provided comments on the draft TMDL. The final TMDL is available at: [https://www.colorado.gov/pacific/sites/default/files/WQ\\_TMDL\\_COSPSV04a-04b-04c-Left%20Hand%20Creek-James%20Creek\\_Final\\_June%202015.pdf](https://www.colorado.gov/pacific/sites/default/files/WQ_TMDL_COSPSV04a-04b-04c-Left%20Hand%20Creek-James%20Creek_Final_June%202015.pdf)

In the TMDL assessment, the parameters and dissolved constituents found to be in need of improvement in various reaches, based on exceedances of chronic aquatic life standards, are shown in Table 1.

Table 1. Parameters and constituents in need of improvement, by reach, in the TMDL assessment.

Reach	pH	Cadmium	Copper	Lead	Zinc
Left Hand Cr from Peak to Peak Hwy to James Cr	x		x		x
James Cr above Little James Cr			x		
Little James Cr		x	x	x	x
James Cr below Little James Cr		x	x	x	x
Left Hand Cr from James Cr to Hwy 36			x		

The chronic aquatic life standards against which ambient concentrations are compared are listed by reach in Table 2. For pH, the standard is consistent, with a goal of being in the range of 6.5 to 9.0 standard pH units. For metals, Colorado uses standards based on hardness, since increasing hardness has been found to provide increasing protection for aquatic life against damage from toxic metals. Since

hardness varies some by reach, the standards also vary somewhat by reach. A summary of ambient conditions is also included in the table.

Table 2. Chronic aquatic life standards and attainment summary for various reaches in the Left Hand Creek Watershed, as reported in the 2015 TMDL Assessment, Table 3.

Segment	Assessed Reach	Hardness mg/L (n)	Cadmium µg/l (n)		Copper µg/l (n)		Lead µg/l (n)		Zinc µg/l (n)		pH s.u. (n)	
			std	amb	std	amb	std	Amb	Std	amb	std	amb
COSPSV04a	Left Hand Creek from Hwy 72 to the Captain Jack Mine	18.6 (3)	0.6	0.0 (8)	2.1	3.96 (18)	0.4	0.32 (16)	28.4	37.8 (16)	6.5-9.0	5.3-6.0 (11)
COSPSV04a	Left Hand Creek from the Captain Jack Mine to Slide Mine	39.8 (35)	1.1	0.97 (20)	4.1	25.1 (125)	0.9	0.44 (118)	54.1	256 (121)	6.5-9.0	5.0-6.0 (92)
COSPSV04a	Left Hand Creek from Slide Mine to James Creek	54.1 (22)	1.4	0.06 (19)	5.3	7.08 (57)	1.3	0.19 (56)	70.2	36.8 (55)	6.5-9.0	6.2-7.5 (32)
COSPSV04b	James Creek, Little James Creek	61.53 (109)	0.29	1.69 (105)	5.91	13.04 (99)	1.48	2.11 (107)	82.16	365.9 (105)	6.6	6.6-7.7
COSPSV04c	Left Hand Creek from James Creek to Hwy 36	60.6 (23)	0.29	0.0 (30)	5.84	4.9 (114)	1.45	0.3 (34)	81.1	29.2 (37)	6.5-9.0	7.2-8.2 (106)

### LWOG Sampling Locations

LWOG samples at 10 River Watch sampling sites along the mountainous reaches of Left Hand Creek, James Creek, and Little James Creek. One of those sites, #577, is not on a stream, but is the drainage from the Yellow Girl Adit just above Jamestown, close to Little James Creek. This site is sampled less frequently than the others and is indicated as “inactive” in the map in Figure 1. In addition to the LWOG sites, the James Creek Watershed Initiative samples James Creek at 5 active sites. Data for one of those sites, #583 James Creek at Cushman-Bar K, are included in this report to show typical values for this reach.

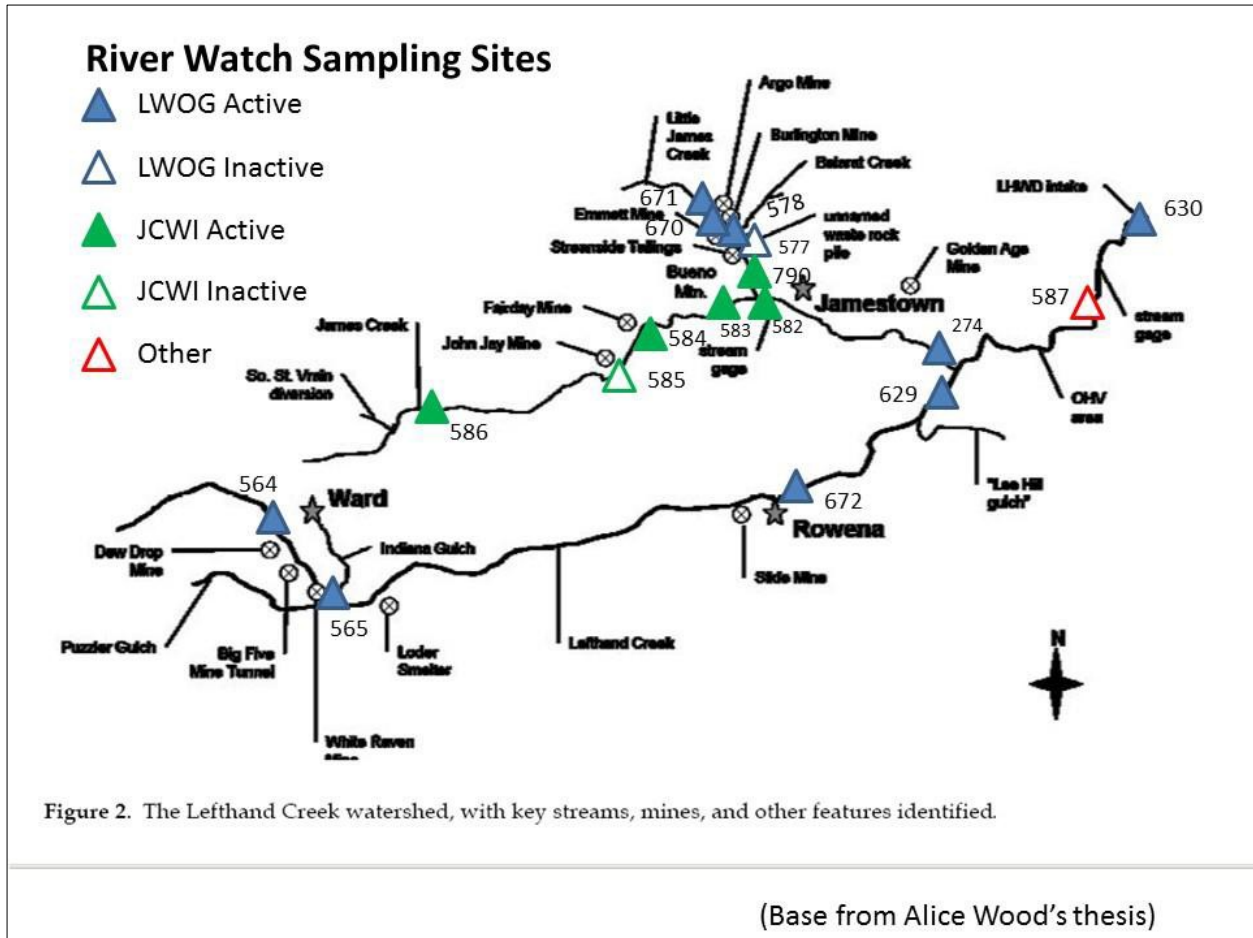


Figure 1. River Watch sampling sites in the mountainous part of the Left Hand Creek Watershed.

Over the years other entities involved in the River Watch program have sampled a number of locations along lower Left Hand Creek in the plains reach. Those sites are shown in Figure 2. Their periods of record are listed in Table 3. Data from Site 588, Nimbus Road, are included in this report to show typical values for the plains reach.

Table 3. Periods of record for River Watch sites on Left Hand Creek sampled by other groups

Site No.	Name	Starting Date	Ending Date	Comment
587	Buckingham Park	1996	2008	Many samples
870	Haystack Mtn Golf Course	2007	2008	5 samples, no metals
588	Nimbus Rd	1996	2006	Many samples
839	Pike Rd	2001	2003	Good number of samples
5106	Main St Bridge	2008	2010	3 samples
3918	Below 287	2010	2010	1 sample



Figure 2. Historic River Watch sites along lower Left Hand Creek.

### Summary of Water Quality Results from LWOG River Watch Sites

For this analysis, all River Watch data from the 10 LWOG sites, plus one of the JCWI sites, for the five parameters and constituents mentioned in the TMDL, were retrieved, plotted, and examined. In general, all five of the parameters and constituents showed exceedances of the chronic aquatic life standards at various times and places. The reaches with the most frequent exceedances included all sites on Little James Creek, and the California Gulch site on Left Hand Creek. James Creek is the cleanest of the three monitored creeks, showing exceedances upstream of Jamestown only for lead, and downstream of Jamestown only for pH. Surprisingly, the site on Little James Creek upstream of Burlington (671), which LWOG originally characterized as a background site, began showing exceedances for all five parameters and constituents during the period 2007-10.

Table 4. Summary of standards exceedances by reach, from the TMDL assessment and from River Watch data.

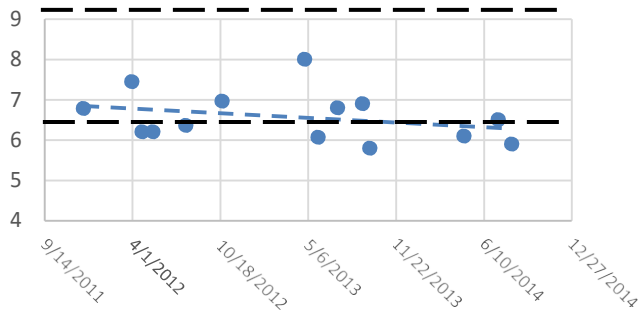
Reach	pH		Cd		C <sub>1</sub>		Pb		Zn	
	TMDL	RW	TMDL	RW	TMDL	RW	TMDL	RW	TMDL	RW
Left Hand Cr from Peak to Peak Hwy to James Cr	x	x			x	x			x	x
James Cr above Little James Cr					x			x		
Little James Cr		x	x	x	x	x	x	x	x	x
James Cr below Little James Cr		x	x		x		x		x	
Left Hand Cr from James Cr to Hwy 36		x		x	x	x				

**pH**

Values for pH showed slightly decreasing trends at all stream sites (Figure 3). The only site with a level trend in pH is the Yellow Girl Adit, which drains to Little James Creek. During recent years, pH values at all LWOG sites, even the background sites on Left Hand Creek and Little James Creek, occasionally or frequently fell below the lower limit for chronic aquatic life standards, 6.5 SU. pH values at a site on James Creek near Cushman-Bar K, monitored by James Creek Watershed Initiative, were safely within the aquatic life standards, but also showed a decreasing trend (figure 4.)

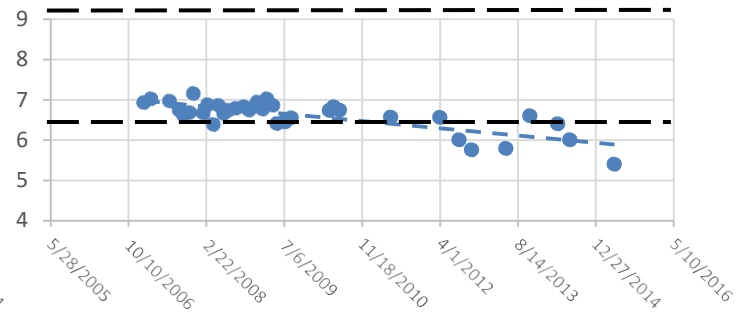
Figure 3 (Next page). pH at LWOG River Watch sites.

564 Left Hand Cr Peak to Peak Hwy

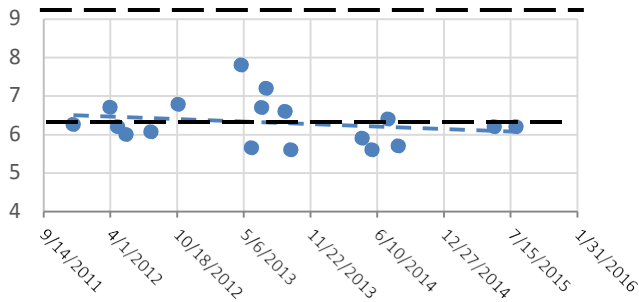


pH

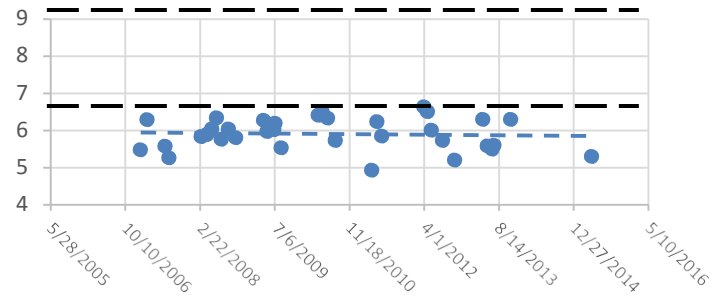
671 L James Cr above Burlington



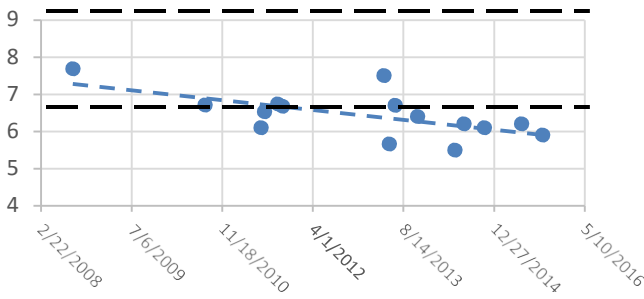
565 Left Hand Cr California Gulch



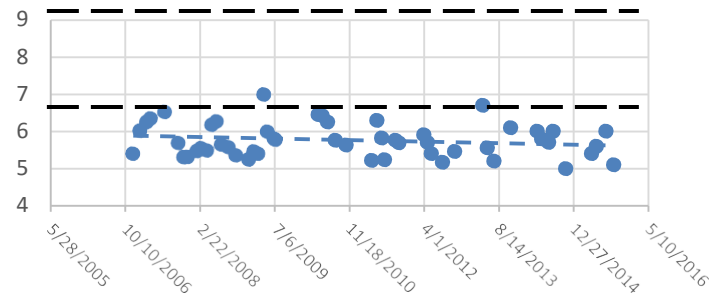
670 L James Cr above Porphyry



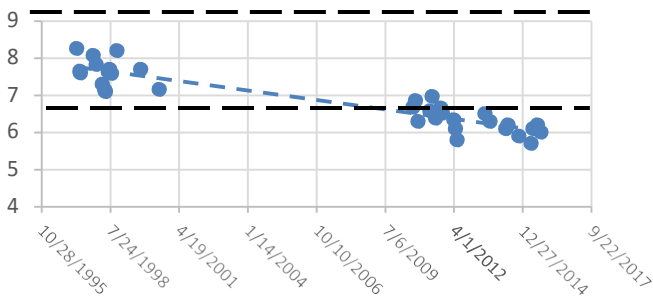
672 Left Hand Cr Homeland



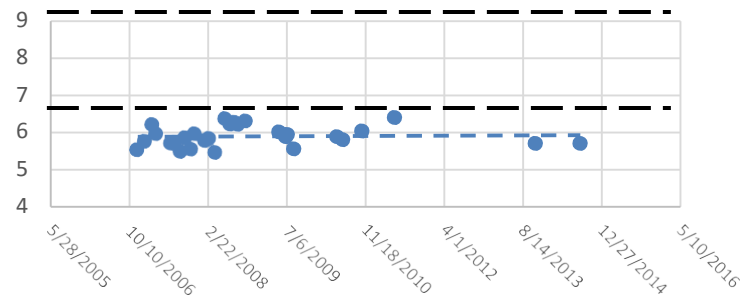
578 L James Cr above Yellow Girl



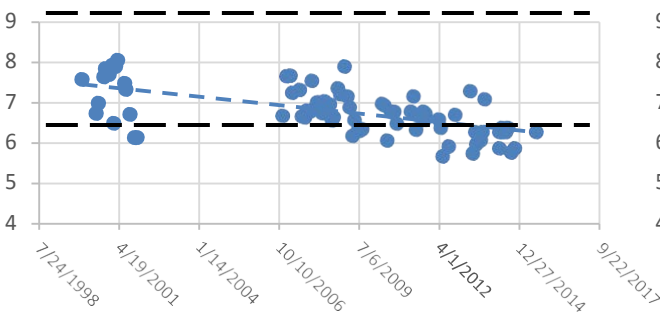
629 Left Hand Cr above James Cr



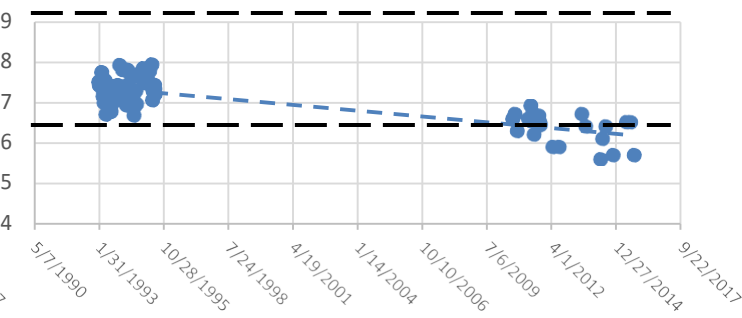
577 Yellow Girl Adit



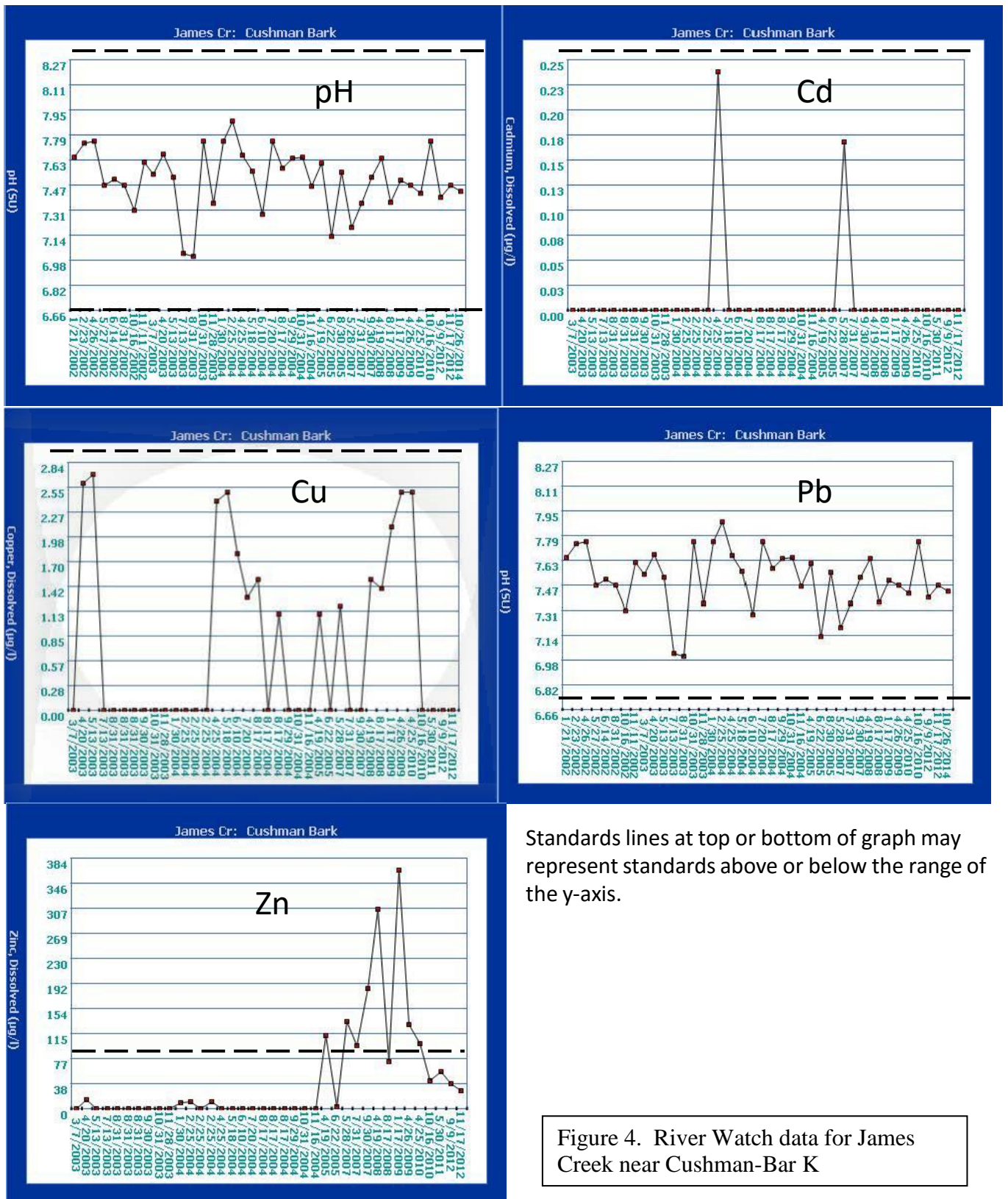
630 Left Hand Cr at Haldi Intake



274 James Cr above Left Hand Cr



# 584 James Creek at Cushman Bar K



Standards lines at top or bottom of graph may represent standards above or below the range of the y-axis.

Figure 4. River Watch data for James Creek near Cushman-Bar K

In light of the somewhat surprising downward trends and low values, additional attention was focused on pH. LWOG River Watch values for pH in Left Hand Creek at the Haldi Intake for the period 2001-15 were plotted along with weekly values for the same location monitored by Left Hand Water District for the period 2010-14 (figure 5). Also plotted on the graph were pH values for the period 1996-2008 from a River Watch monitoring station on Left Hand Creek at Buckingham Park, located 2 miles upstream from the Haldi Intake.

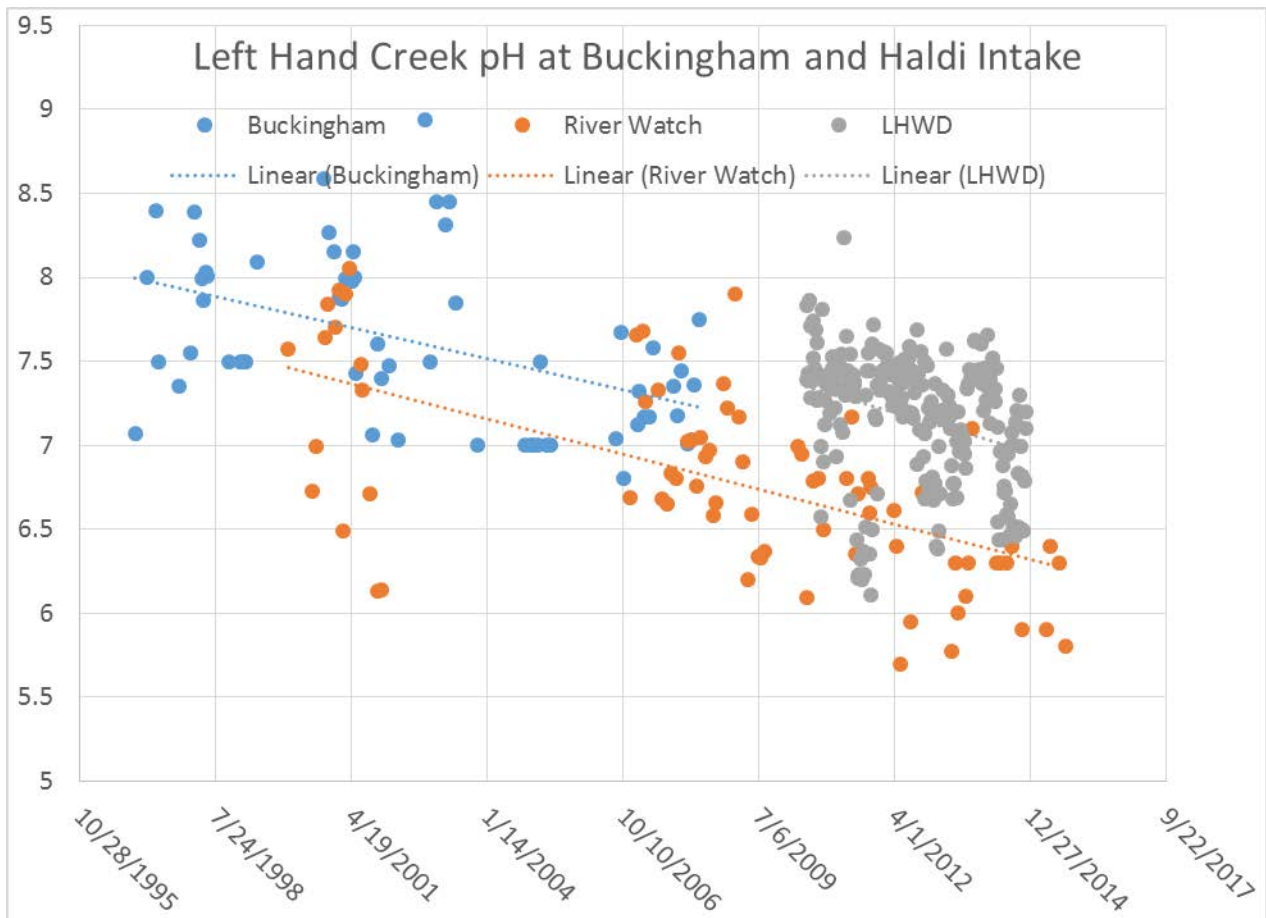


Figure 5. Comparison of pH values near Haldi Intake from 3 sources

These pH values were analyzed by an entity other than LWOG. All three traces show approximately parallel decreasing trend lines, indicating that the downward trend in pH is real. However, the LWOG River Watch pH data tended to have lower values compared to the Buckingham Park data (by about 0.4 pH unit), and compared to the LHWD data (by about 0.6 pH unit). Additional comparisons will be made during 2016 to further analyze these differences.



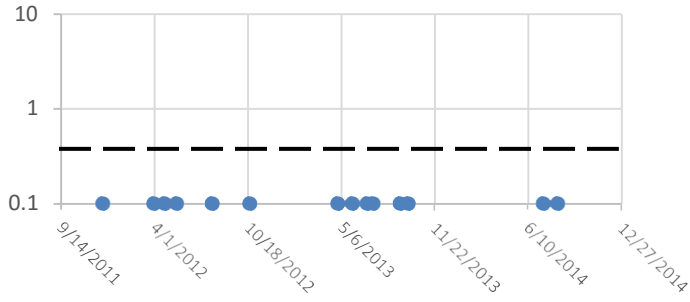
## **Cadmium**

Concentrations of dissolved cadmium were near or below detection limits in nearly all samples from Left Hand Creek (figure 6). In recent years, only the site on Left Hand Creek with dissolved cadmium approaching the aquatic life standard was the site in California Gulch, just downstream of the Superfund site. Trends in recent years have been slightly downward. In James Creek, both at Cushman-Bar K (figure 4) and just upstream of Left Hand Creek (figure 6), dissolved cadmium concentrations were near or below detection limits since 2011 or earlier. However, all sites on Little James Creek, including the site upstream of Burlington that was thought to represent background conditions, had concentrations of dissolved cadmium in excess of the aquatic life standards (figure 6). As with Left Hand and James Creeks, the cadmium concentrations were trending slightly downward.

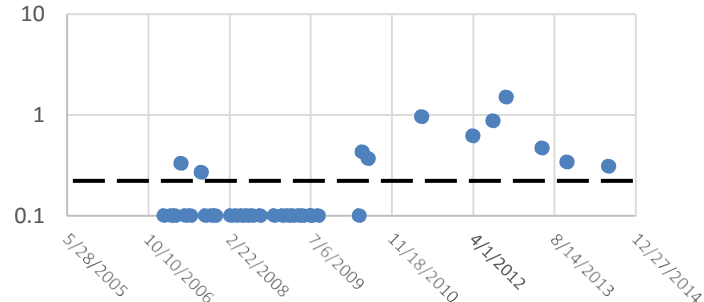
Figure 6 (Next page). Dissolved cadmium at LWOG River Watch sites

**Cd**

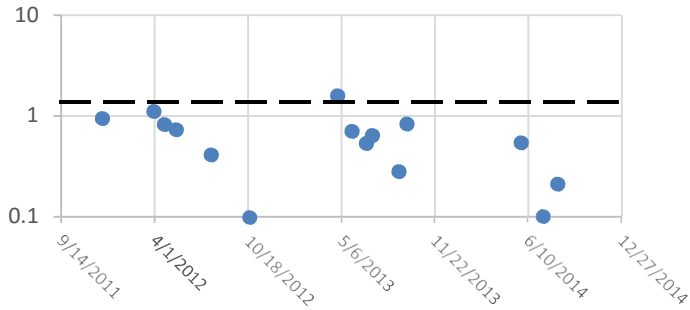
564 Left Hand Cr Peak to Peak Hwy



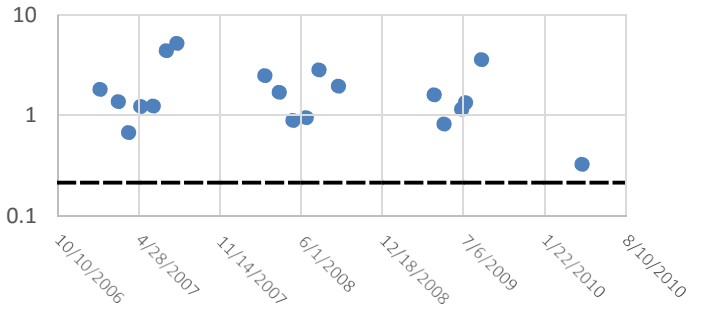
671 L James Cr above Burlington



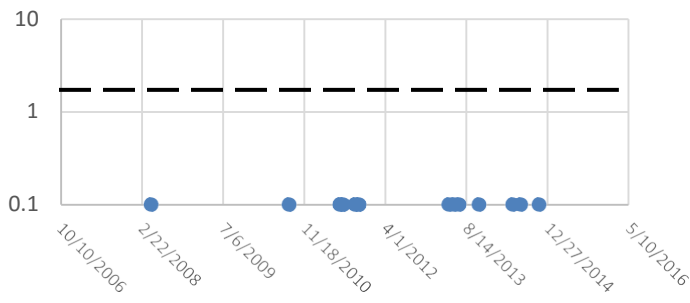
565 Lefthand Cr California Gulch



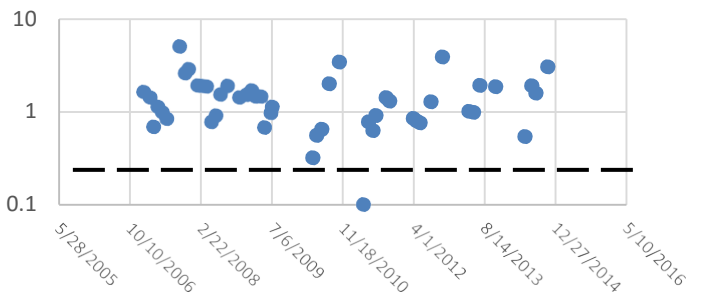
670 L James Cr above Porphyry



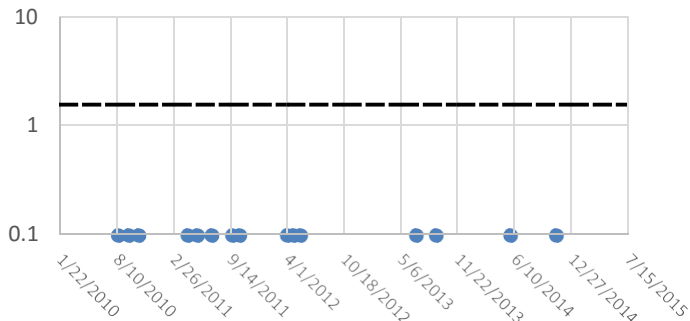
672 Left Hand Cr Homeland



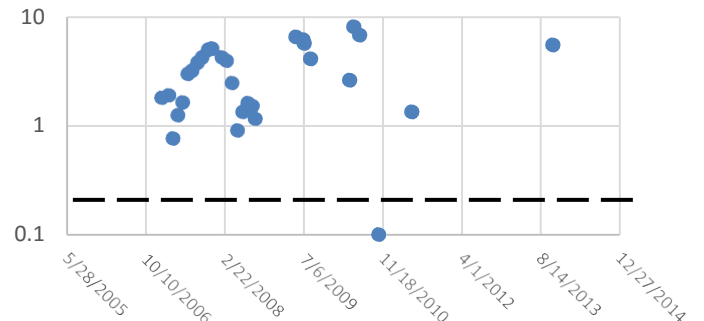
578 L James Cr above Yellow Girl



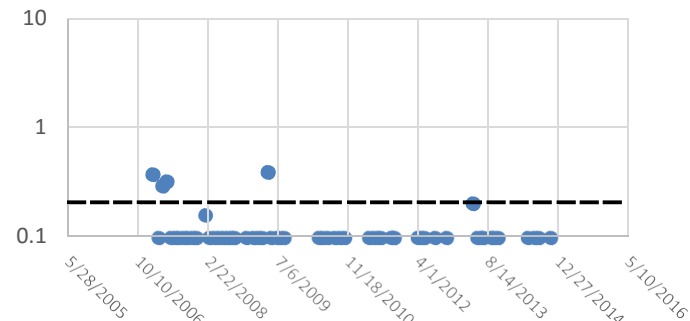
629 Left Hand Cr above James Cr



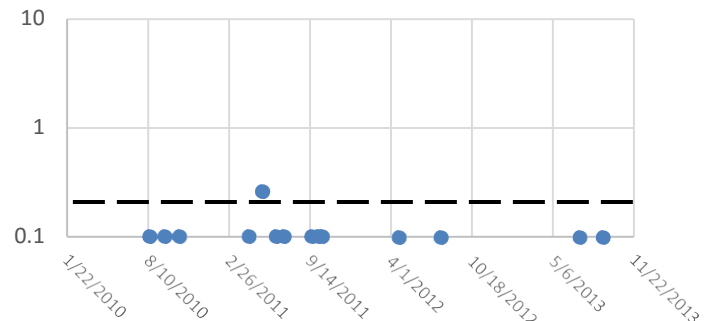
577 Yellow Girl Adit



630 Left Hand Cr Haldi Intake



274 James Cr above Left Hand Cr

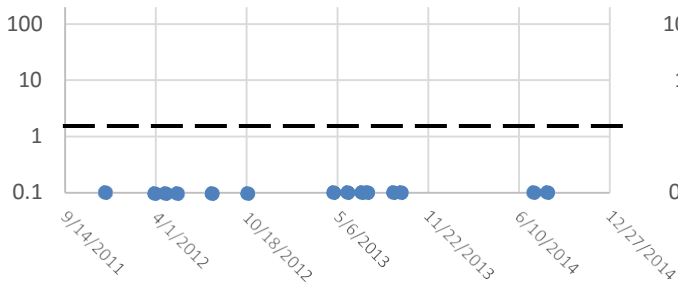


## **Copper**

In Left Hand Creek, dissolved copper was absent from the background site at the Peak to Peak Highway, but present at all other sites (figure 7). The site on Left Hand Creek with the most significant exceedances of aquatic life standards was the site in California Gulch, but the other sites on Left Hand Creek also had some exceedances. Trends were slightly downward. In James Creek, dissolved copper was present but below aquatic life standards at Cushman-Bar K (figure 4), and, since 2011, present but below aquatic life standards at the site above Left Hand Creek (figure 7). All sites on Little James Creek, including the site upstream of Burlington, had dissolved copper concentrations in excess of aquatic life standards (figure 7). Trends at all sites are slightly downward in recent years.

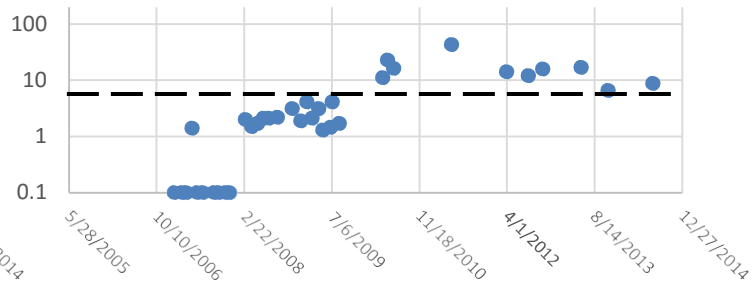
Figure 7 (Next page). Dissolved copper at LWOG River Watch sites.

564 Left Hand Cr Peak to Peak Hwy

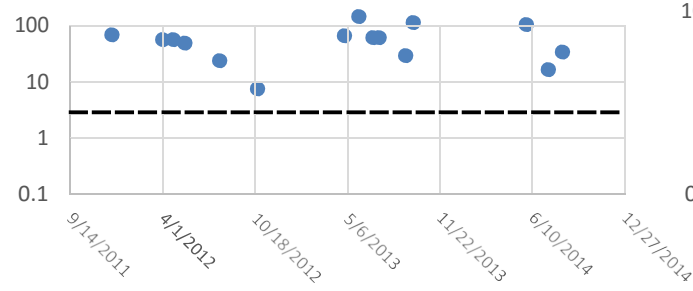


Cu

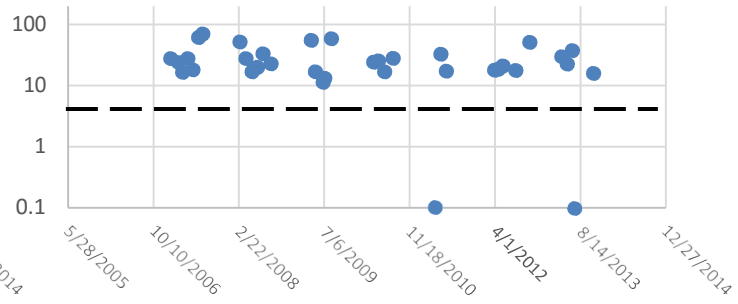
671 L James Cr above Burlington



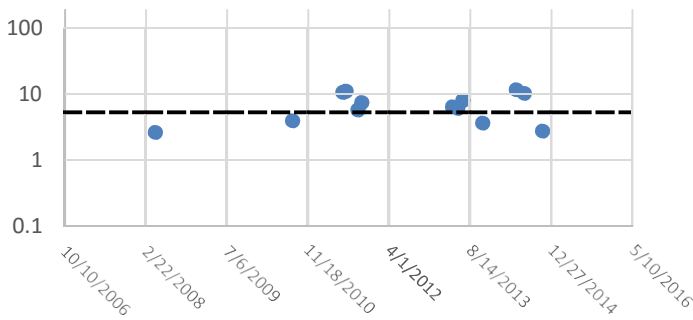
565 Left Hand Cr California Gulch



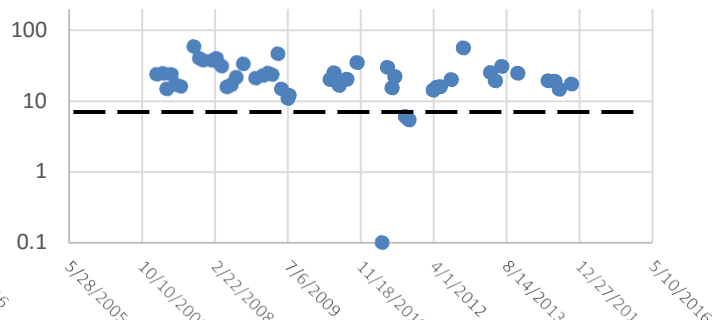
670 L James Cr above Porphyry



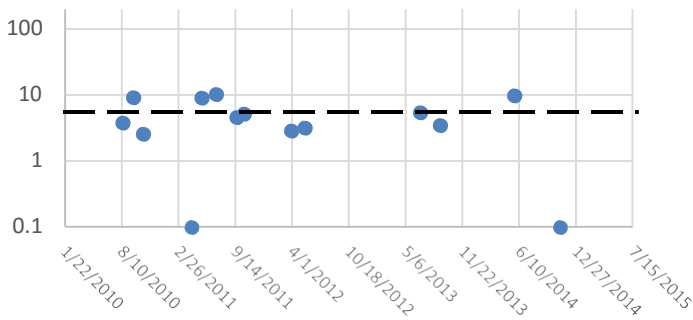
672 Left Hand Cr Homeland



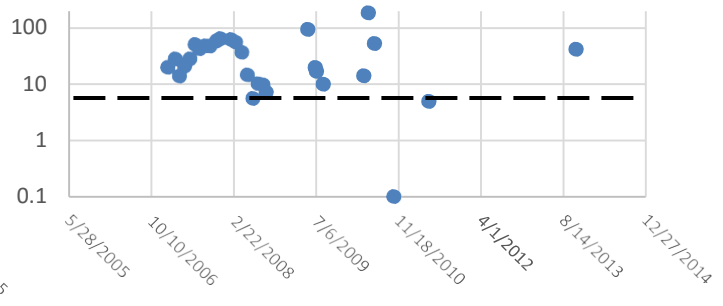
578 L James Cr above Yellow Girl



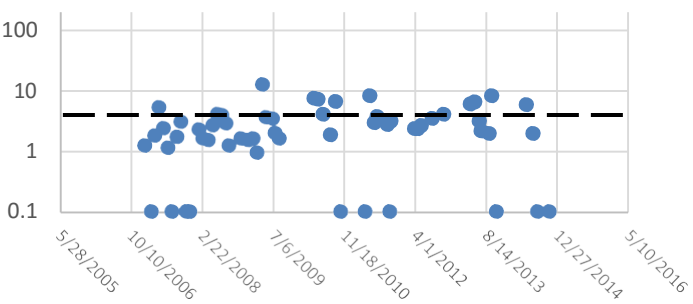
629 Left Hand Cr above James Cr



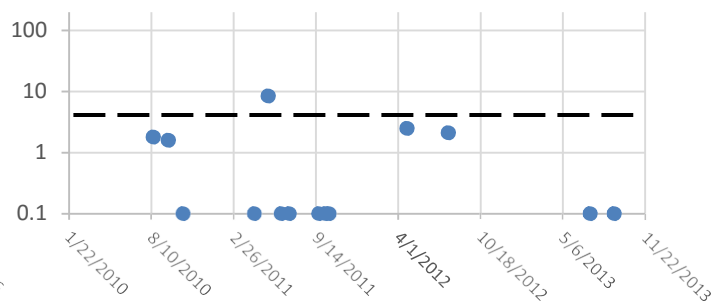
577 Yellow Girl Adit



630 Left Hand Cr Haldi Intake



274 James Cr above Left Hand Cr

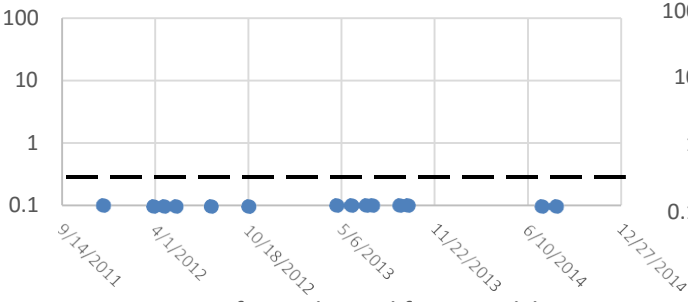


## **Lead**

In Left Hand Creek, dissolved lead has not been detected above the detection limit at any site since 2008 (figure 8.) In James Creek, dissolved lead consistently exceeded aquatic life standards at the Cushman-Bar K site above Jamestown (figure 4), but was below detection limits farther downstream, at the site just above the confluence with Left Hand Creek (figure 8). All sites on Little James Creek, including the site upstream of Burlington, had dissolved lead concentrations in excess of aquatic life standards (figure 8). Trends at all sites where lead occurred were downward in recent years.

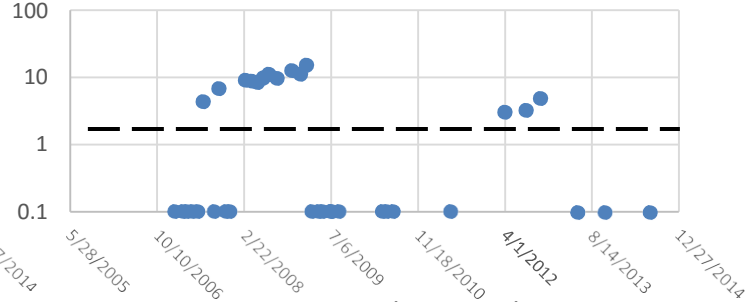
Figure 8 (Next page). Dissolved lead at LWOG River Watch sites.

564 Left Hand Cr Peak to Peak Hwy

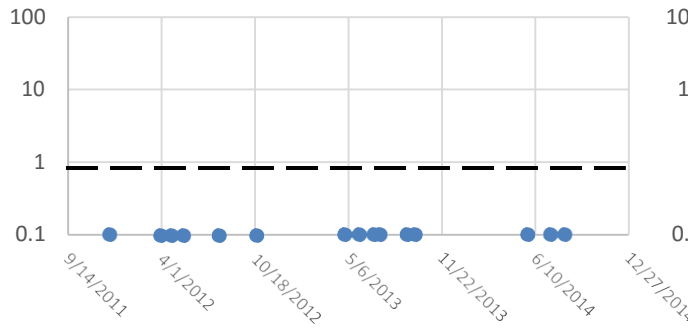


**Pb**

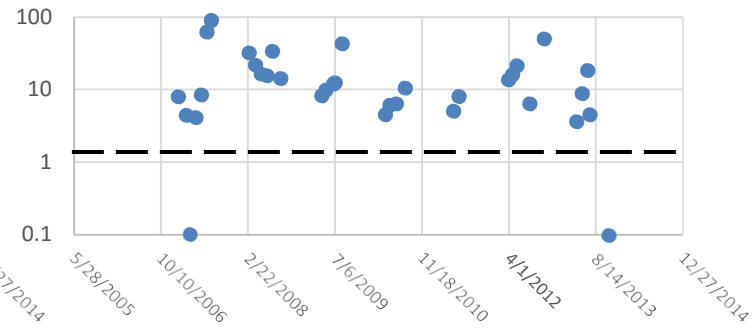
671 L James Cr above Burlington



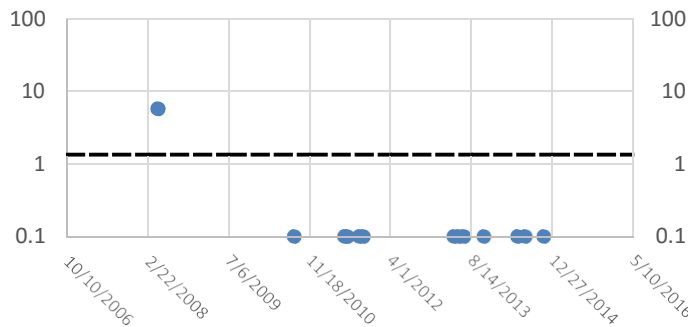
565 Left Hand Cr California Gulch



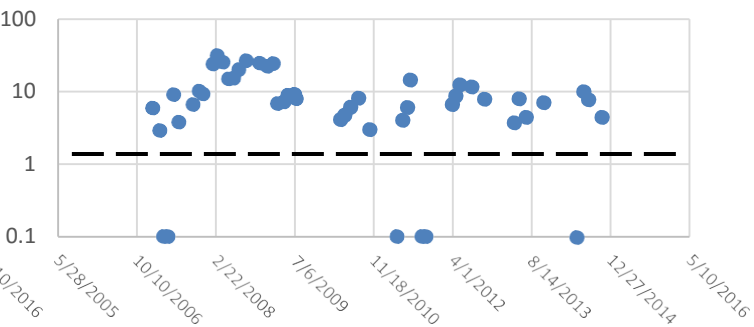
670 L James Cr above Porphyry



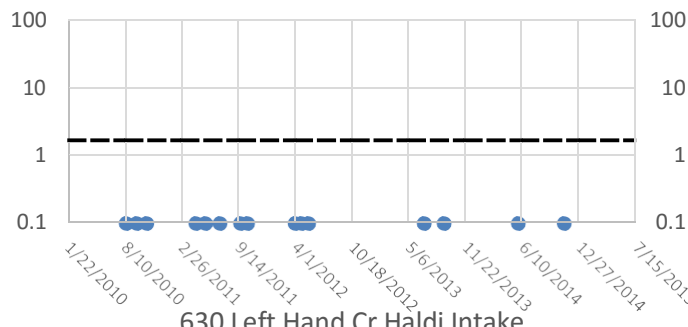
672 Left Hand Cr Homeland



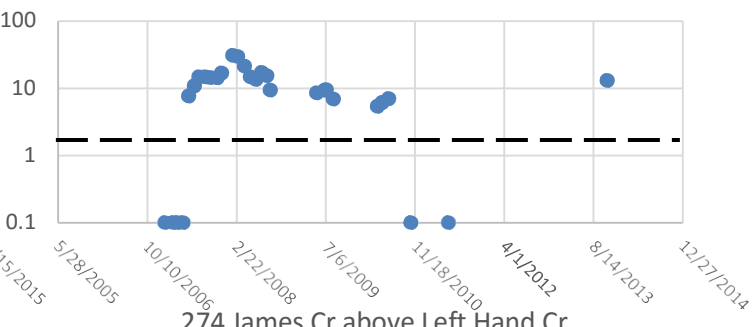
578 L James Cr above Yellow Girl



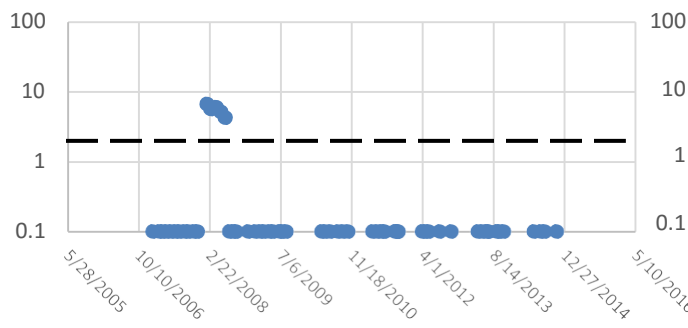
629 Left Hand Cr above James Cr



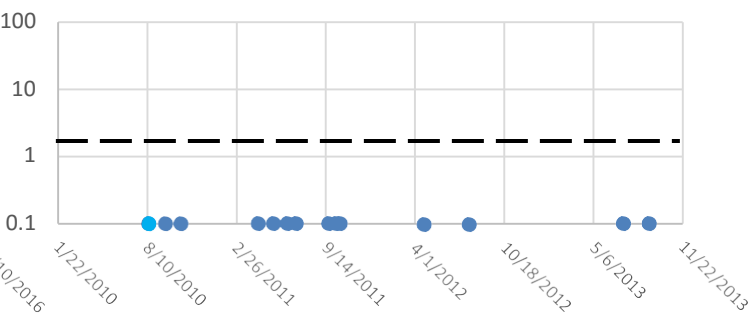
577 Yellow Girl Adit



630 Left Hand Cr Haldi Intake



274 James Cr above Left Hand Cr

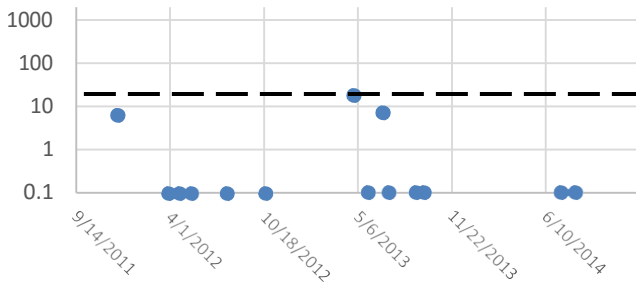


## Zinc

Zinc is fairly ubiquitous in the mining-impacted parts of Left Hand Creek Watershed. In Left Hand Creek, concentrations of dissolved zinc were lowest, often below the detection limit, at the background site at Peak to Peak Highway (figure 9). By contrast, at the site in California Gulch just below the Superfund site, dissolved lead was usually above the aquatic life standard. At the three sites farther downstream on Left Hand Creek, dissolved lead was usually present, but not quite above the aquatic life standard. Trends are downward in recent years. On James Creek, dissolved lead was near or below the detection limit at the Cushman-Bar K site prior to 2004. Then, between 2004 and 2010, concentrations were consistently in excess of the aquatic life standard. Since 2010, they have again dropped below the aquatic life standard (figure 4). Farther downstream on James Creek just above the confluence with Left Hand Creek, concentrations of dissolved zinc were above the detection limit but below the aquatic life standard. Trends were downward. On Little James Creek, as with cadmium, copper and lead, concentrations of dissolved zinc were consistently above aquatic life standards at all sites including the one upstream of Burlington (figure 9). Trends in recent years were slightly downward.

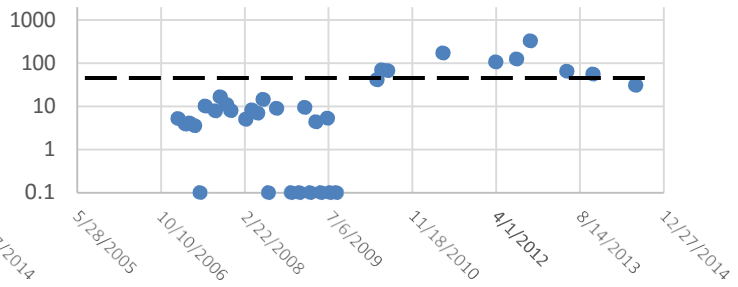
Figure 9 (Next page). Dissolved zinc at LWOG River Watch sites.

564 Left Hand Cr at Peak to Peak Hwy

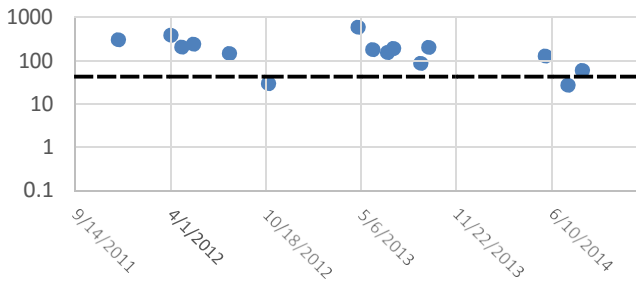


Zn

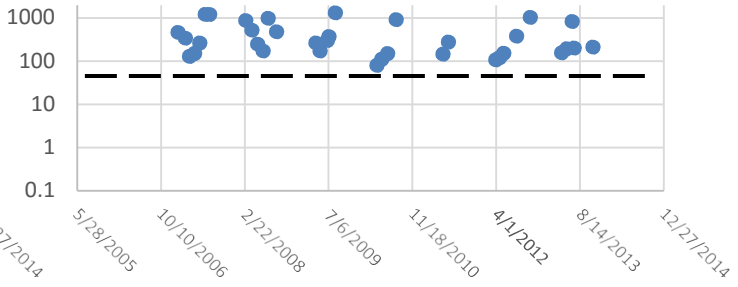
671 L James Cr above Burlington



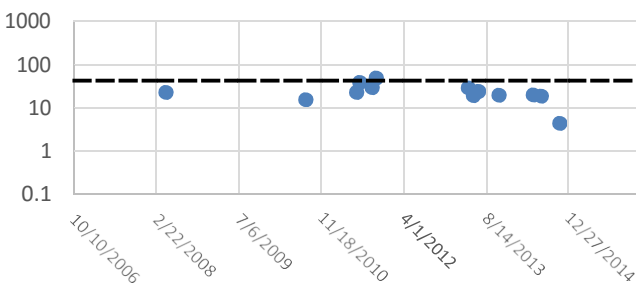
565 Left Hand Cr California Gulch



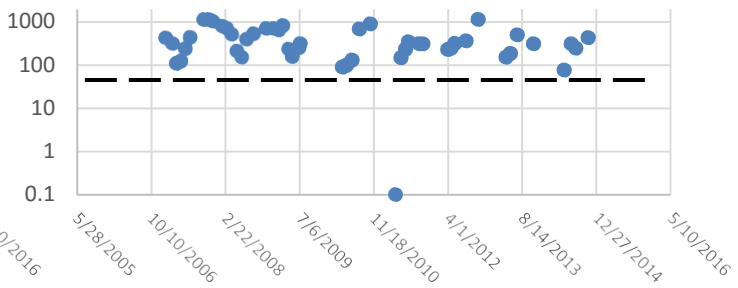
670 L James Cr above Porphyry



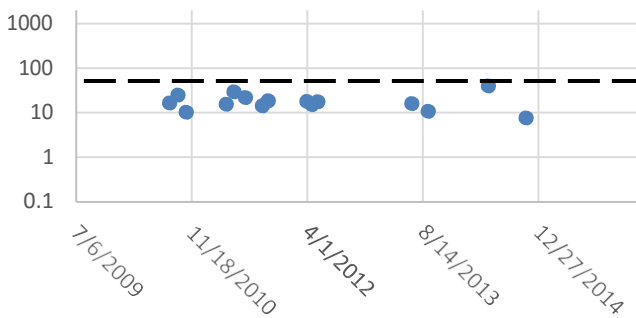
672 Left Hand Cr Homeland



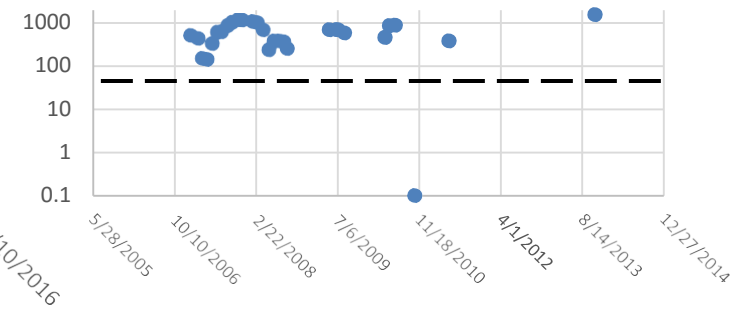
578 L James Cr above Yellow Girl



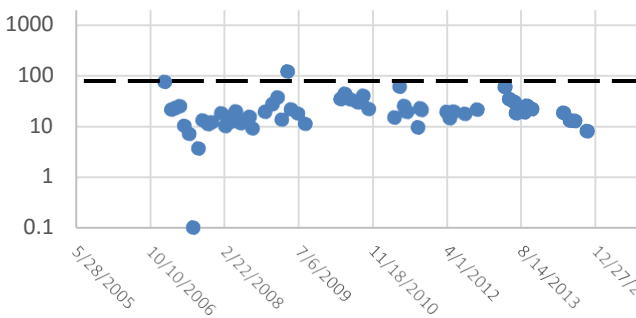
629 Left Hand Cr above James Cr



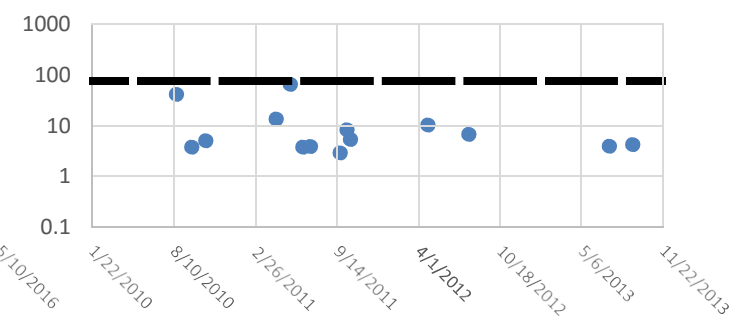
577 Yellow Girl Adit



630 Left Hand Cr Haldi Intake



274 James Cr above Left Hand Cr





### **Bacterial Water Quality of Rowena Spring**

LWOG has taken a few samples from a spring next to the Rowena reach of Left Hand Creek, about ½ mile upstream from the Homeland site, and had them analyzed for bacteria and metals. This spring is frequently used by nearby residents for drinking water. On December 10, 2013 and July 13, 2014, the spring tested negative for fecal coliforms but positive for total coliforms. This indicated a likely connection between the spring water and surrounding soil—a common condition for natural springs. The latter sample was also tested for metals, and none were found to be in detectable ranges. Some repairs were made to the spring by residents, and it was re-tested on August 4, 2015. This time the result was negative for E. coli and for total coliforms, indicating a safe drinking water source.

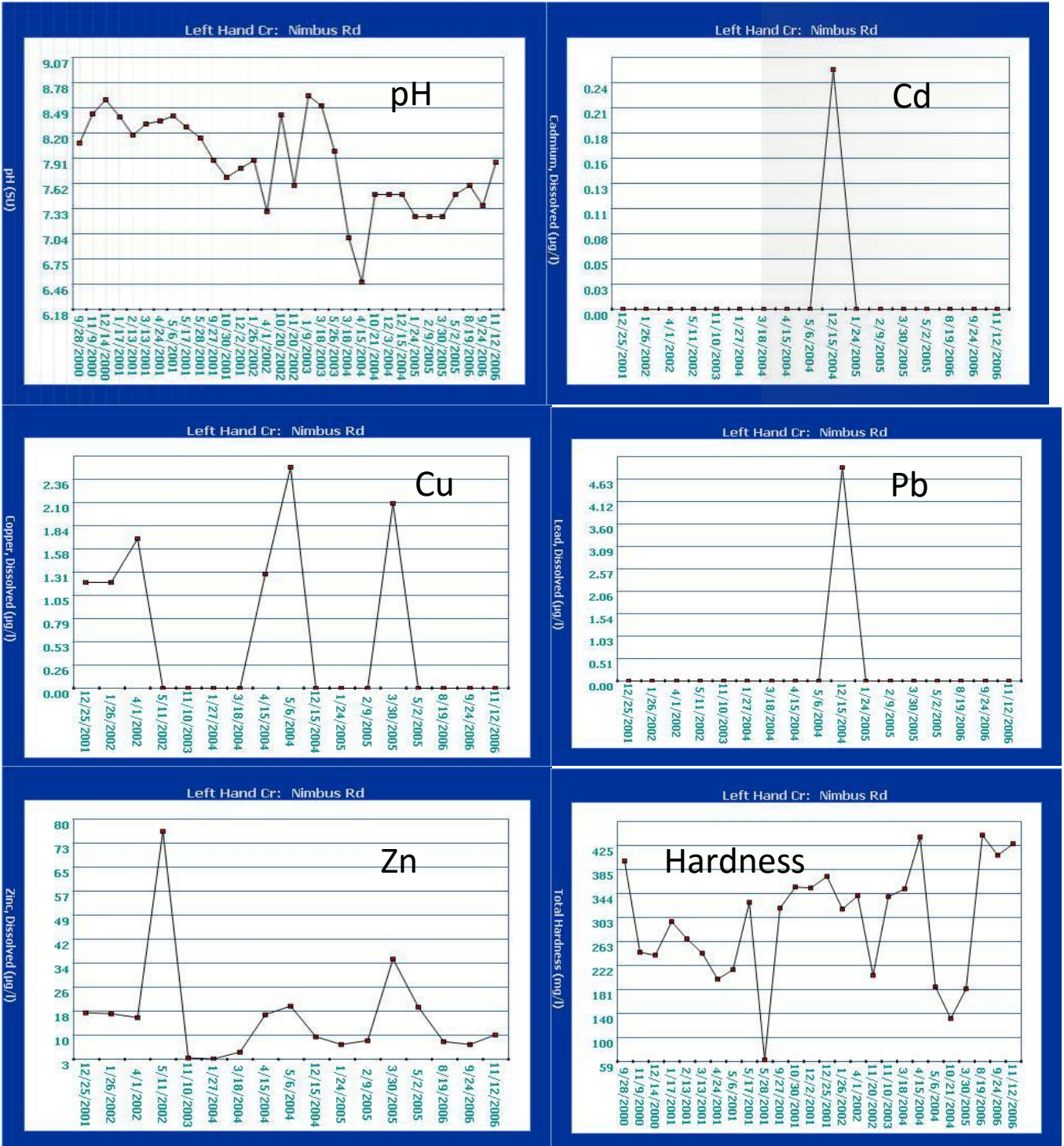
### **Water Quality in the Plains Reach of Left Hand Creek**

While most of LWOG's water quality monitoring has traditionally been focused the mining-impacted reaches in the mountainous part of the watershed, some information is available about water quality in the plains reach, and LWOG is beginning to pay more attention to water quality in this reach. As an example of water quality status in this reach for the same parameters and constituents discussed above, we can take a look at a relatively data-rich former River Watch site on Left Hand Creek at Nimbus Road (figure 10). The period of record for this site is 2000-06. During that period, no chronic aquatic life standards related to pH, cadmium, copper, lead, or zinc were violated. pH followed a generally decreasing trend, but the levels were higher than farther upstream, comfortably within aquatic life standards. Cadmium and lead were observed above the detection limit only once, in 2004. Copper and zinc were detected more frequently, but were still well below the aquatic life standards.

Figure 10 (Next page). Water quality in Left Hand Creek at Nimbus Road, 2000-2006.

# 588 Left Hand Creek at Nimbus Road

No values on this page exceed aquatic life standards.



## Hardness

In the mountainous reaches of the watershed hardness is generally low to moderate, in the range of 10-100 mg/L. At the Haldi Intake, hardness tends to peak in or near May, and reach a minimum value in or near July (figure 11).

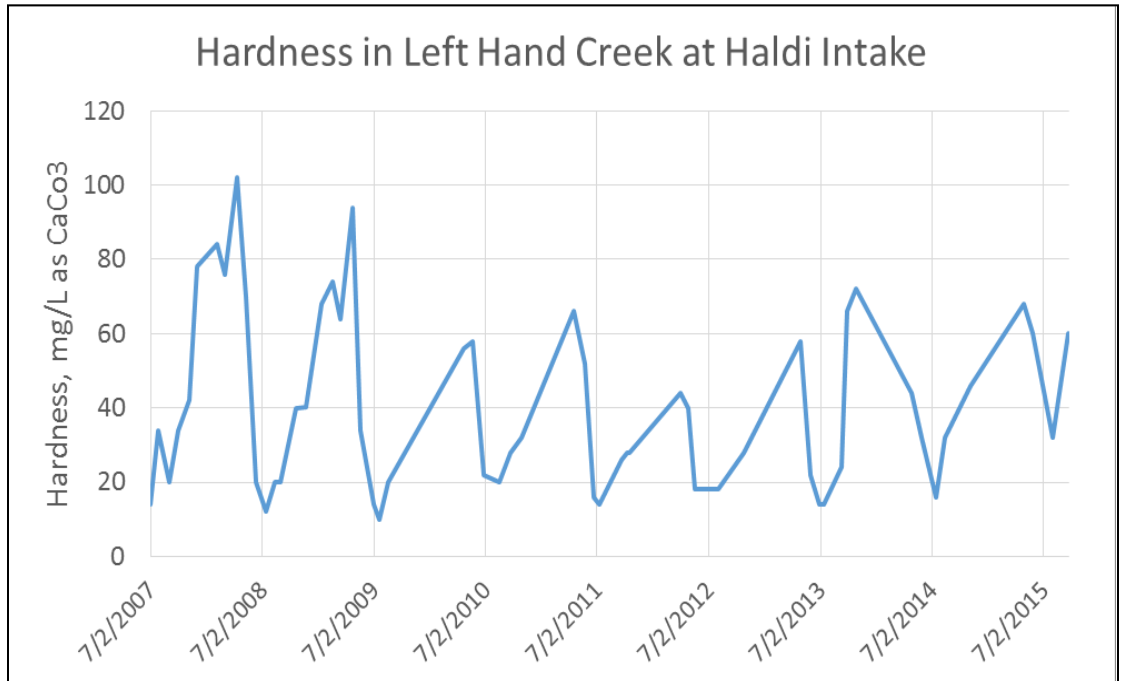


Figure 11. Hardness in Left Hand Creek at Haldi Intake.

As the creek flows through the plains reach, hardness tends to increase. Values at Nimbus Road during 2000-06 ranged from about 100 to about 430 mg/L (figure 10). The seasonal pattern evident at Haldi was not observed at this site. LWOG has taken two samples for hardness from Left Hand Creek at 81<sup>st</sup> Street, in October 2015 and January 2016. These values were 624 and 224 mg/L, respectively. According to information provided by John Brown, a hardness value for this site calculated for March 2011 was 316 mg/L.

## Summary

In summary, Left Hand Creek and its tributaries continue to violate chronic aquatic-life standards for pH, copper, and zinc. The site on Left Hand Creek with the most frequent violations is just below the Superfund site. James Creek above Jamestown consistently violates the standards for lead, and violated the standard for zinc from 2004-10. Little James Creek consistently violates the standards for pH, cadmium, copper, lead, and zinc. Trends for pH have been decreasing, indicating a tendency for creek water to become more acidic over time. Trends for metals have generally been decreasing, indicating a tendency for less metal contamination over time. The violations of aquatic life standards appear to be confined to the mountainous reaches; water quality in the plains reach was within acceptable limits during the period 2000-06. However, in the plains reach, hardness increases downstream, reaching values as high as 624 mg/L at 81<sup>st</sup> Street.

