United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington, D.C. 20240

To: Gina Andrews, On-Scene Coordinator, USEPA

From: Dan Wall, Environmental Response, USFWS

Subject: Data Interpretation – Standard Mine Site

cc: Jennifer Slavick, Life Scientist, USEPA, Christina Progess, Remedial Project Manager, USEPA, Richard Graham, USEPA

Gina,
Per your request, I am evaluating the comments you received from the State of Colorado Department of Public Health and the Environment concerning potential ecological effects of waste rock piles and/or tailings in the impoundment at the Standard Mine Site. The specific comments received are:

From an ecological perspective, there is no technical evidence that the waste rock piles and/or tailings in the impoundment, under ambient conditions, are a chronic impact to the water quality of Elk Creek or the aquatic resources in Coal Creek. Although there may be a short-lived impact during spring run-off when run-off flows come in contact with the waste rock this impact is likely mitigated by the volume of water in both Elk Creek and Coal Creek during the spring run-off period.

EPA has conducted 4 sampling events to support development of an ecological risk assessment for the site. None of the sampling events had the specific objective of precisely evaluating the magnitude of contamination that may be leaching from the waste rock or from the tailings impoundment on the site. The data collected do however, allow for estimates to be made regarding the potential for ecological effects to aquatic organisms. My professional opinion is that because of the relatively small footprint of the tailings impoundment/waste rock piles and the lack of habitat associated with the waste, risk to mobile terrestrial receptors is fairly low. A more thorough evaluation of risk to terrestrial receptors is being prepared as part of the baseline risk assessment and this will provide more definitive answers. The focus of this evaluation, as is raised in the States concerns, will be on the potential risk to aquatic receptors from tailings in the impoundment and waste rock on the site.

Relevant data collected from the June, July and September sampling events included water and sediment metal concentrations, with concurrent flow measurements, benthic toxicity tests and fish and benthic invertebrate population demographics. Sampling stations include Elk-29 (upstream of level 1 and the adit in Elk creek), SM-00 (mouth of the adit), Elk-10 (immediately below the tailings impoundment in Elk creek), Coal 20 (upstream of Coal Creek/Elk Creek Confluence) and Coal 15 (downstream of Coal Creek/Elk Creek Confluence).

Loading to Water

To estimate the potential loading to Elk Creek from waste rock/tailings impoundment, the loading of Zn, Cu and Cd were calculated at Elk-29, Sm-00 and Elk-10 for the June, July and September sampling events (See Figures 1-3). During certain times of the year for Zn and Cd, there is an increase in metals loading between Elk-29 and Elk-10 in excess of loading from the SM-00. In June and September, Zn loads of 1.8 and 0.67 lbs/d (dissolved metals) respectively, are attributable to non-point sources emanating from the site. This is calculated by subtracting the loads at Elk-29 and SM-00 from the load at Elk-10. A similar pattern for Cd in June and September is also observed (0.007 and 0.002 lbs/d dissolved metals, respectively). The July event and all results for copper indicate a decrease in metal load between Elk-10 and the 2 upstream sites.

Converting the dissloved metals load at Elk-10 to a concentration suggests that the metals load from non-point sources into Elk Creek is sufficient to exceed water quality standards and potentially harm aquatic receptors (see table 1 below). .

Table 1 Calculated Concentrations at Elk-10 without Upstream Loads

Sampling Event	Analyte	Hardness	Calculated Concentration (ug/L)	AWQC (chronic)
June	Zn	50	416	67
June	Cd	50	2	0.16
September	Zn	98	1553	118
September	Cd	98	4	0.25

The origin of the non-point source loading is not definitively indicated by this calculation and there are several potential sources of error in the data including laboratory analysis, flow measurements and sampling technique. Additionally, there were significant alterations to the site that could influence these results and effect potential loading from non-point sources in the future. After the July sampling event several diversion ditches were enabled to minimize the amount of clean water that runs onto the site and the tailings impoundment was neutralized and dewatered. Neutralized water was discharged to Elk creek after the July event and before the September event. It is unknown if these changes to the site will be sufficient to decrease loading from the waste rock/tailings to acceptable levels.

Finally, 13 waste rock and tailings samples were subjected to Synthetic Precipitate Leaching Procedure (SPLP) to determine the leachability of metals. Zinc results indicate that there is potential for significant leaching from waste rock piles and tailings. The results ranged from 0.064 mg/L to 53 mg/L. These results are consistent with the loading calculations above.

Erosion of Waste Rock and Tailings

Another pathway whereby the waste rock/ tailings can negatively impact aquatic receptors is through contamination of sediment. Elk Creek is a high gradient cobble bottomed stream that has high flows during runoff. It was observed when we collected these samples that fine particulate sediment is not

readily present in most areas of Elk Creek and that most of the substrate is coarse. Figure 4 is a graph of the zinc sediment concentrations for all samples collected in support of the ecological risk assessment along the entire length of Elk Creek. Generally speaking the results indicate substantial variability in zinc concentrations between sampling events but substantially less variability between sites within a sampling event. The combination of the high flows that Elk Creek receives during runoff, the steepness of the creek, the large particle size of the substrate and the relatively uniform concentration of zinc from the top of Elk Creek to the bottom suggest that the contamination in the sediment is largely due to tailings and waste rock eroding from the site. Figure 4 presents results of 2 samples that were collected for sediment toxicity tests. The samples were transported to the laboratory and used to expose sediment dwelling organisms. Because the contamination in the sediment was considered relatively uniform from the top of Elk Creek to the mouth of Elk Creek, only 2 samples were collected for sediment toxicity testing (Elk-08; below the Copley drainage and Elk-00 near the mouth of Elk). The results of the toxicity testing indicate 97.5% mortality at Elk-08 and 100% mortality at Elk-00. These results and observation suggest that unless erosion of the waste rock and/or tailings is controlled, adverse effects to sediment dwelling organisms will continue.

Invertebrates are present in Elk Creek and results of sampling invertebrate populations indicate that most stations on Elk Creek had impaired invertebrate populations, some highly impaired. The degree of impact to invertebrate populations appears to be positively related to their proximity to the site.

Impacts to Coal Creek

Risks to aquatic organisms appear in Coal Creek appear low. Figure 5 does however indicate a substantial increase in zinc concentrations in Coal Creek downstream of the Elk Creek confluence (Coal-15) as compared to the upstream concentrations (Coal-20). Laboratory toxicity tests were conducted on sediment samples presented in Figure 5 and results indicate over 90% survival of sediment organisms at both stations despite the increased in metals concentrations. Table 2 contains select metrics of the benthic macroinvertebrate populations in Coal Creek from two sampling events. The stations are immediately upstream (Coal-20) and immediately downstream (Coal-15) of the confluence of Elk and Coal Creeks. The metrics were selected based on their responsiveness to metal contamination. They include the total number of organisms, total number of taxa (families), total number of EPT taxa (metals sensitive families-Ephemeroptera, Plecoptera and Trichoptera), % EPT and mayfly abundance. Generally the results are comparable between the 2 sites but there are some inconsistencies between the 2 sampling events that may be attributable to seasonal differences. Both populations appear diverse with a comparable percentage of metals sensitive organisms being present.

Table 3 is a summary of rudimentary measures of the fish populations above and below Elk Creek on Coal Creek. The number of fish immediately below the Elk Creek confluence is 2-3 times greater than above Elk Creek but the size of the average length and weight of the fish are less. This effect may or may not be due to metals contamination as habitat, competition and food availability may also affect fish size. Brook Trout was the only species captured at these stations.

Table 2 Select Benthic Macroinvertebrates Indices Bracketing Elk and Coal Creek Confluence on Coal Creek

Station	Relative to Elk Confluence	Date	TOTAL (#/sample)	Number of Taxa	EPT taxa	% EPT (% of total Taxa)	Mayfly Abundance (% of total)
Coal 15	Downstream	Jul-06	401	30	18	60	64
Coal 20	Upstream	Jul-06	207	30	17	57	57
Coal 15	Downstream	Sep-05	940	27	12	44.4	49
Coal 20	Upstream	Sep-05	1102	40	20	50	19.3

Table 3 General Fish Population Metrics in Coal Creek

Station	# of Fish	Average Length mm	Average Weight gm
Below Elk	78	132	33
Above Elk	25	150	56
Further Above Elk	36	143	50

Implications of Tailings Impoundment Failure

Tailings from historic mining at the Standard Mine are contained in an impoundment that sits immediately adjacent to Elk Creek. Failure of the impoundment and subsequent release of most or all of the tailings into Elk Creek are of concern. Because of the steep gradient of Elk Creek and the probability that the impoundment would fail under an extreme runoff event I would anticipate that the released tailings would extend well into Coal Creek. The effects would likely run a continuum of severe impacts near the site to minor impacts at some downstream location. The footprint of tailings deposition would be the most severe impact based on both the physical and chemical effects on the stream bed. Areas inundated with tailings would eliminate virtually all benthic invertebrate habitat by filling in spaces in the cobble that are needed by most resident insects to survive and by fish to reproduce. Over time the tailings may settle and consolidate, embedding the cobble firmly in the streambed. This has been observed at several mine sites and may take years to decades to resolve itself naturally. This impact is likely to be observed in Coal Creek. Immediate chemical impacts to downstream aquatic populations would likely be observed as a pulse of high levels of metal contamination was released with and from the tailings. Fish kills in Coal Creek would be probable. For some period of time after the failure, metals from the released tailings would be leached into the stream and would likely produce localized areas of lethal concentrations of metals. Gradually the leachable metals would be depleted and areas that weren't inundated with tailings would begin to recover.

Summary

The *available* information suggest that the while the metals loading from the adit drainage is the major risk to aquatic receptors, tailings/waste rock from the site are by themselves presenting unacceptable levels of risk to aquatic organisms in Elk Creek. This risk is from both waterborne metals from non-point source loading from the site and erosion of material from the site. It is unknown if alterations to the site conducted during the Summer of 2006 will be sufficient to reduce this risk to acceptable levels.

Clearly, site related contamination is apparent in Coal Creek that is likely from eroded tailings/waste rock but risk to organisms in Coal Creek is considered low and no clear impacts were observed.

It is important to realize that a more thorough evaluation of risk to ecological receptors is ongoing as part of the baseline ERA and these conclusions are subject to change as more data becomes available and additional analyses are conducted.

Expected Benefits of Tailings/Waste Rock Removal and Improved Water Quality
Fish were only observed at the mouth of Elk Creek in low numbers. Based on the calculations above, observations of the site and consultation with Colorado Division of Wildlife representatives on-site, it is anticipated that if waste from the adit *and* tailings/waste rock were no longer entering Elk Creek a Brook trout fishery would be sustainable in Elk Creek. Sufficient habitat was observed on Elk Creek to support fish and their prey base and fish were observed in Splains Gulch (a reference location for Elk Creek) at comparable, albeit slightly lower elevation.

Sincerely

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Figure 1

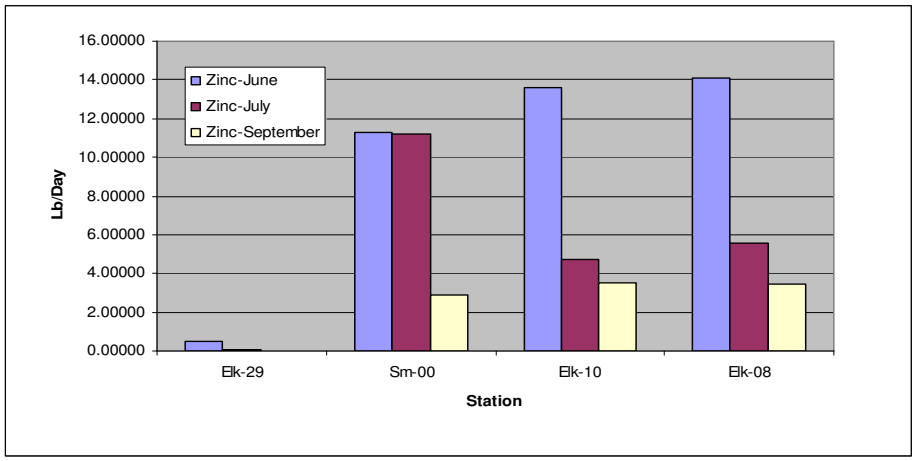

Figure 2

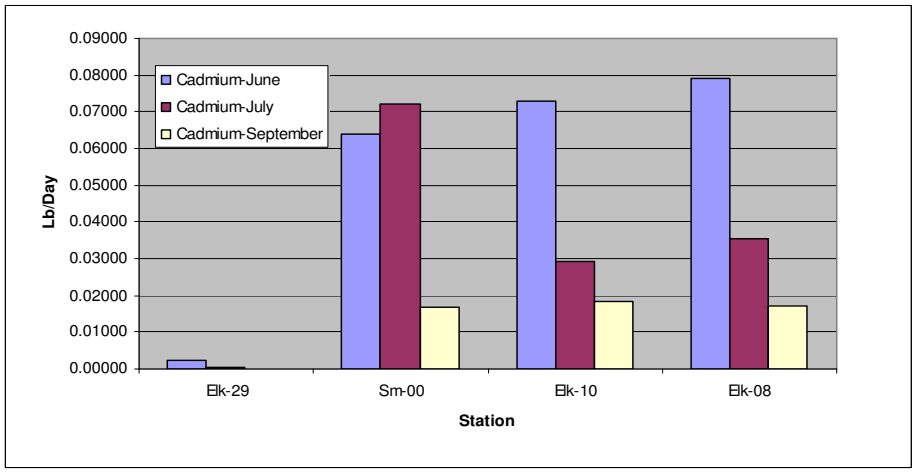

Figure 3

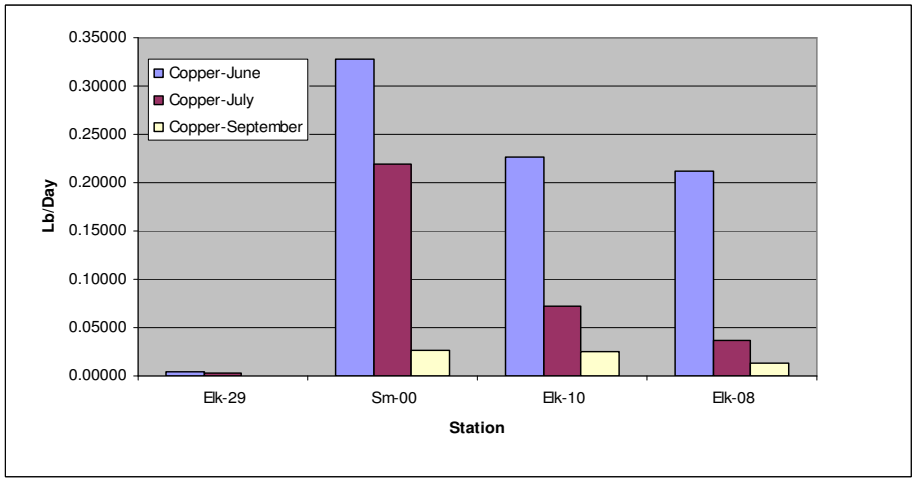

Figure 4 Zinc Concentrations in Elk Creek Sediment

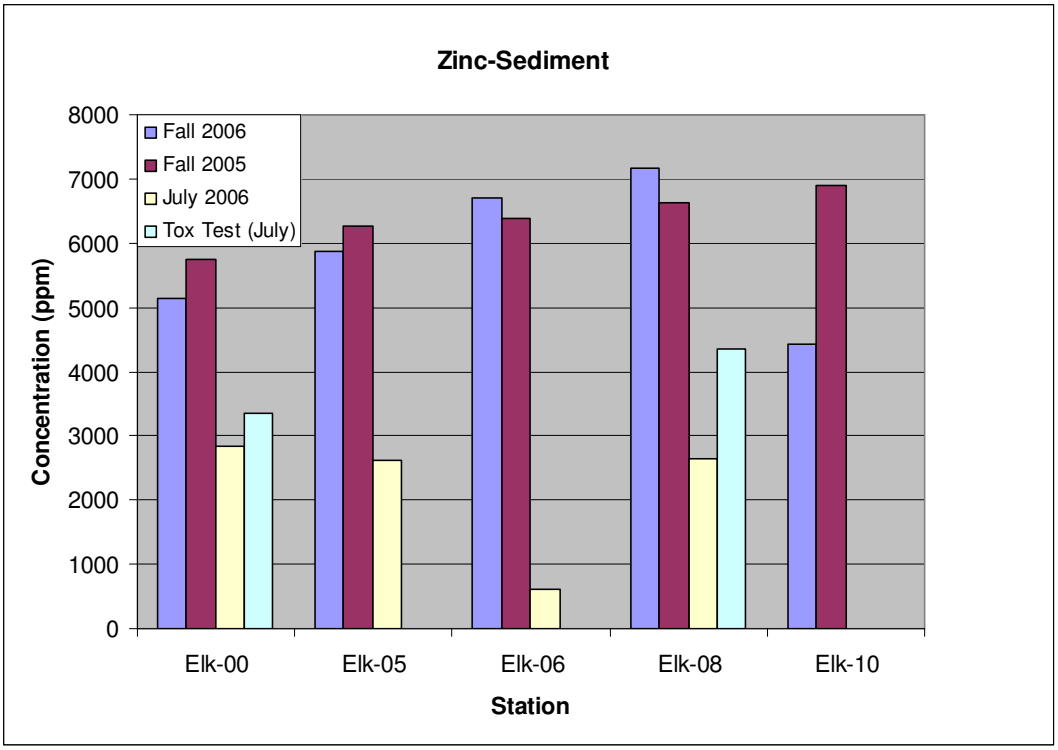

Figure 5 Zinc Concentrations in Coal Creek Sediment Upstream and Downstream of Elk Creek