September 9, 2016

UTAH DEPARTMENT *of*
ENVIRONMENTAL QUALITY
WATER QUALITY

Evaluation of UDEQ Water Quality Data following the Tibble Fork Reservoir Sediment Release

Data Collected: August 22-28, 30, 31, and September 1, 3, 5, and 6, 2016

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Executive Summary

On August 23, 2016 the Division of Water Quality was notified of an unplanned release of sediment from Tibble Fork Reservoir into the North Fork of the American Fork River. DWQ collected water chemistry and sediment samples on August 23rd through August 30th to characterize the impact the release had on human health, the aquatic environment, and downstream water users. The National Park Service at Timpanogos National Monument collected data on August 22, 2016. These data sets have been evaluated in the context of human health, aquatic life, and agricultural uses of American Fork River. The data support the following main findings:

- Dissolved and total metal concentrations in water quality samples collected on August 23 through August 28, 2016 below Tibble Fork Reservoir are 2 to 10 times higher than the concentrations of metals above Tibble Fork Reservoir.
- Total metal concentrations collected below the reservoir on Monday August 22, 2016 are significantly higher than the samples collected by DWQ on Tuesday through Sunday, August 23-28, 2016. This suggest that the DWQ samples are not representative of the worst conditions in the river that occurred between August 20 and August 22, 2016.
- Measurements of water clarity (turbidity and total suspsended solids) indicate clear violations of Utah's narrative and numeric water quality standards. As of September 6, 2016, the water clarity had improved to levels which are in compliance with the numeric standards set in the Utah Water Quality Act.
- Concentrations of dissolved metals in water quality samples collected above and below Tibble Fork Reservoir on August 22, 2016 do not violate Utah's water quality standards for aquatic life or agricultural uses.
- Concentrations of total metals in the water column collected on August 22 through August 28 below Tibble Fork Reservoir do not exceed human health screening values for recreational exposures.
- Sediment metal concentrations collected below Tibble Fork Reservoir exceed human health screening values for lead and exceed aquatic life screening values for arsenic, cadmium, copper, lead, manganese, nickel, and zinc.
- Sediment metal concentrations collected above Tibble Fork Reservoir on August 23, 2016 also exceed freshwater aquatic life screening values for arsenic, cadmium, lead, and zinc. The magnitude of these exceedances are not as pronounced as the data for samples collected below the reservoir.
- At the request of local city governments, water samples were taken from Highland Glen Reservoir, Heritage Park, and Manila Reservoir on August 31, 2016. These recreation sites are downstream from the canyon and are all fed by irrigation water drawn from American Fork Creek. Analysis of total and dissolved metals in the samples confirmed the levels do not exceed the EPA screening standards for recreational use, agriculture, or aquatic life.

Introduction

DEQ collected water samples at five locations on the American Fork River and North Fork American Fork River following the Tibble Fork Reservoir sediment release on August 23-28, and August 30, 2016 (Table 1, Figure1). In addition, samples were taken from two unaffected tributary streams on August 25,2016. These data include water chemistry and sediment samples for a broad range of heavy metals and were screened against recreational, agricultural, and aquatic life criteria. Results for this screening analysis are presented in the following sections of this summary.

Table 1. Monitoring Locations for Assessment of Tibble Fork Sediment Release.

Monitoring Location ID	Monitoring Location Name	Latitude	Longitude
4994980	American Fork River at mouth of Canyon	40.431898	-111.750767
4994984	American Fork River BL Cave Camp Springs	40.441851	-111.714216
4994983	S FK American FK R ½ mile AB Mutual Dell	40.444401	-111.640064
4994990	N FK American FK R AB confl S FK	40.456062	-111.661863
5912810	N FK American FK R BL Tibble Fork Res	40.479396	-111.647428
5912830	Deer Creek AB Tibble Fork Res	40.482251	-111.647085
5912840	N FK American FK CK AB Tibble Fork Res	40.48384	-111.640474

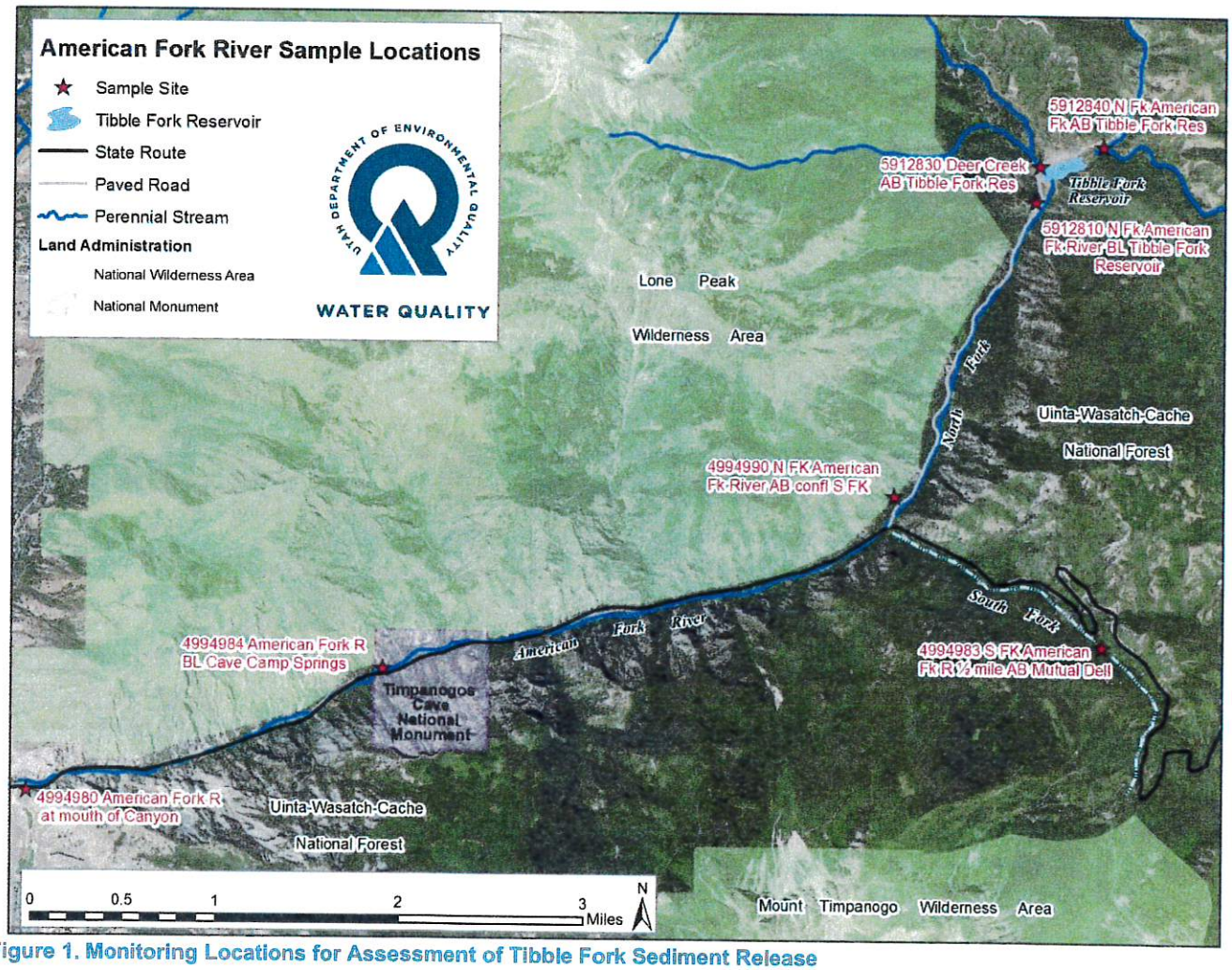


Figure 1. Monitoring Locations for Assessment of Tibble Fork Sediment Release

Water Screening Analysis

Standards and Screening Values used in Evaluation of American Fork River Water Quality Samples

The table below summarizes applicable water quality standards for the American Fork River watershed (R317-2-14), as well as screening values for recreational and agricultural uses. Water quality standards for the American Fork River watershed consist of numeric values for metals and other chemical constituents and are intended to be protective of the watershed's beneficial uses. Beneficial uses for the American Fork River include cold water aquatic life use, irrigation and stock watering agriculture uses, and infrequent contact recreational uses. The water quality standards associated for these uses are presented in the table below.

Recreational screening values were developed by the Utah Department of Health's Environmental Epidemiology Program (EEP). These values reflect the water contaminant concentrations that would equal established ATSDR minimal risk levels (MRL), or EPA reference doses (RfD) if an appropriate MRL does not exist, for children between two and six years old, a sensitive population. These recreational screening values assume a short duration of exposure during the week between the initial sediment release and the completion of the reservoir bypass channel. Exposure to water and sediment is assumed to be via wading and playing in the river. Swallowing river water is thought to be unlikely as it is too shallow for swimming and people using area campgrounds would likely bring potable water. An exceedance of these values does not necessarily indicate that adverse health effects will occur; rather, it indicates that further evaluation is warranted. Agricultural screening values are derived from National Academy of Science (NAS) Water Quality Criteria, 1972 (the Blue Book). Those guidelines are reprinted in EPA's Guidelines for the Reuse of Waters for Irrigation. Dissolved metal values were used for the assessment of agricultural use waters. Estimated results values below the laboratory's reporting limit are evaluated in this analysis. These results generally show low level concentrations and do not significantly affect the analysis outcome.

Table 2. Aqueous Metals Screening Values

Analyte	CAS #	Units	Utah WQ Standards (R317-2-14) for American Fork River Uses [Dissolved metals]			Recreational Screening Values [Total Metals]	Agricultural Screening Values [Dissolved Metals]			Analyte
			3A (cold water fish) [1-hour]	3A (cold water fish) [4-day]	4 (agriculture)		Livestock Water (ug/L)	Long-Term Irrigation Waters (ug/L) [NAS, 1972]	Short-Term Irrigation Waters (ug/L) [NAS, 1972]	
Hardness	-	mg/L					180 mg/L (UA)			Hardness
Aluminum	7429-90-5	µg/L	750	87		1,579,090.7	5,000 (NAS)	5,000	20,000	Aluminum
Antimony	7440-36-0	µg/L				631.6	No Data Available	No Data Available	No Data Available	Antimony
Arsenic	7440-38-2	µg/L	340	150	100	7,895.5	200 (NAS)	100	2,000	Arsenic
Barium	7440-39-3	µg/L				315,818.1	No Data Available	No Data Available	No Data Available	Barium
Beryllium	7440-41-7	µg/L				3,158.2	No Data Available	No Data Available	No Data Available	Beryllium
Cadmium	7440-43-9	µg/L	2	0.25	10	789.5	50 (NAS)	10	50	Cadmium
Calcium	7440-70-2	µg/L					500,000 (UA)	No Data Available	No Data Available	Calcium
Chromium	7440-47-3	µg/L	16 (VI); 570 (III)	11 (VI); 74 (III)	100	1,786,865.7	1,000 (NAS)	100	1,000	Chromium
Cobalt	7440-48-4	µg/L				39,477.3	1,000 (NAS)	50	5,000	Cobalt
Copper	7440-50-8	µg/L	13	9	200	15,790.9	500 (NAS)	200	5,000	Copper
Iron	7439-89-6	µg/L	1000	1000			Limit Not Considered Necessary (NAS)	5,000	20,000	Iron
Lead	7439-92-1	µg/L	65	2.5	100	14,796.1	100 (NAS)	5,000	10,000	Lead
Magnesium	7439-95-4	µg/L					250,000 (UA)	No Data Available	No Data Available	Magnesium
Manganese	7439-96-5	µg/L				74,217.3	Limit Not Considered Necessary (NAS)	200	10,000	Manganese
Mercury	7439-97-6	µg/L	-	0.012		11,053.6	10 (NAS)	No Data Available	No Data Available	Mercury
Molybdenum	7439-98-7	µg/L				7,895.5	No Data Available	10	50	Molyebdenum
Nickel	7440-02-0	µg/L	468	52		157,909.1	No Data Available	200	2,000	Nickel
Potassium	7440-22-4	µg/L					No Data Available	No Data Available	No Data Available	Potassium
Selenium	7782-49-2	µg/L	18.4	4.6	50	7,895.5	50 (NAS)	20	20	Selenium
Silver	7440-22-4	µg/L	1.6	-		13,159.1	No Data Available	No Data Available	No Data Available	Silver
Sodium	7440-23-5	µg/L					1,000,000 (UA)	No Data Available	No Data Available	Sodium
Thallium	7440-28-0	µg/L				63.2	No Data Available	No Data Available	No Data Available	Thallium
Vanadium	7440-62-2	µg/L				15,790.9	100 (NAS)	100	1,000	Vanadium
Zinc	7440-66-6	µg/L	120	120		789,545.3	25,000 (NAS)	2,000	10,000	Zinc
TDS		mg/L					1200 (Utah)	500,000-1,000,000 (NAS)		
pH							6.5-9 (Utah)	4.5-9 (NAS)		
Boron	7440-42-8	µg/L			750	315,818.1				
Tin	7440-31-5	µg/L				473,727.2				

RMEG: ATSDR Reference Dose Media Evaluation Guide
EMEG: ATSDR Environmental Media Evaluation Guide
RSL: EPA Regional Screening Level

Comparison of America Fork River Water Data with Water Quality Criteria (R317-14-2) for Aquatic Life Use (Cold-water Fishery) – Dissolved Metals

The water concentrations of metals and metalloids were compared to Utah's chronic and acute water quality standards for the Class 3A cold-water aquatic life use. All of Utah's aquatic life criteria are based on dissolved fractions with the exception of aluminum which is based on total recoverable fraction. No exceedances of acute or chronic aquatic life criteria were observed. However, the analytical method used for mercury does not have sufficient sensitivity and the detection limit is higher than the standard. Therefore, all nondetect concentrations are too high to determine if the water concentrations comply with the standard. As a result, DWQ can not determine if mercury concentrations pose a risk to aquatic life uses.

Aquatic Life Use (Dissolved Metals)

No Exceedence | Above Screening Level

Monitoring Location	Site Description	Collection Date	Collection Time	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			Utah Aquatic Life Use 1-hour	750		340			2	570		13	1000	65				468	18.4	1.6			120
			Utah Aquatic Life Use 4-hour	87		150			0.25	74		9	1000	2.5		0.012		52	4.6				120
				ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
5912840	N FK American FK CK AB Tibble Fork Res	8/23/2016	2:25 PM	ND	ND	ND	42.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	7.9
		8/25/2016	4:35 PM	ND	ND	ND	40.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8
		8/26/2016	11:40 AM	ND	ND	ND	41.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8
		8/27/2016	8:55 AM	ND	ND	ND	42.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	11.3
		8/28/2016	8:40 AM	ND	ND	ND	41.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8
		8/30/2016	2:10 PM	ND	ND	ND	40.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	7.8
5912830	Deer Creek AB Tibble Fork Res	8/25/2016	4:21 PM	ND	ND	ND	95.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	ND	ND	ND	ND	ND
5912810	N FK American FK R BL Tibble Fork Res	8/23/2016	2:45 PM	ND	4.1	7.9	148.0	ND	ND	ND	ND	ND	ND	ND	149.0	ND	3.2	ND	ND	ND	ND	ND	ND
		8/24/2016	4:25 PM	ND	4.2	6.5	130.0	ND	ND	ND	ND	ND	ND	ND	121.0	ND	2.9	ND	ND	ND	ND	ND	ND
		8/25/2016	4:08 PM	ND	2.6	5.2	111.0	ND	ND	ND	ND	ND	ND	ND	99.4	ND	2.7	ND	ND	ND	ND	ND	ND
		8/26/2016	11:17 AM	ND	2.1	5.4	112.0	ND	ND	ND	ND	ND	ND	ND	104.0	ND	2.6	ND	ND	ND	ND	ND	ND
		8/27/2016	9:27 AM	ND	3.1	5.4	109.0	ND	ND	ND	ND	ND	ND	ND	114.0	ND	3.0	ND	ND	ND	ND	ND	ND
		8/28/2016	9:00 AM	ND	ND	3.3	86.8	ND	ND	ND	ND	ND	ND	ND	55.7	ND	2.2	ND	ND	ND	ND	ND	ND
		8/30/2016	2:35 PM	ND	2.1	ND	58.7	ND	ND	ND	ND	ND	ND	ND	15.8	ND	2.5	ND	ND	ND	ND	ND	ND
4994990	N FK American FK R AB confl S FK	8/23/2016	3:00 PM	ND	4.4	6.0	120.0	ND	ND	ND	ND	ND	ND	ND	98.0	ND	3.1	ND	ND	ND	ND	ND	ND
		8/25/2016	3:48 PM	ND	3.4	4.8	105.0	ND	ND	ND	ND	ND	ND	ND	73.9	ND	2.7	ND	ND	ND	ND	ND	ND
		8/26/2016	12:20 PM	ND	2.5	5.3	107.0	ND	ND	ND	ND	ND	ND	ND	82.2	ND	2.7	ND	ND	ND	ND	ND	ND
		8/27/2016	9:45 AM	ND	3.3	4.3	95.6	ND	ND	ND	ND	ND	ND	ND	90.3	ND	3.1	ND	ND	ND	ND	ND	ND
		8/28/2016	9:20 AM	ND	ND	3.2	87.0	ND	ND	ND	ND	ND	ND	ND	48.6	ND	2.3	ND	ND	ND	ND	ND	ND
		8/30/2016	2:45 PM	ND	ND	2.0	62.7	ND	ND	ND	ND	ND	ND	ND	13.7	ND	2.3	ND	ND	ND	ND	ND	ND
4994983	S FK American FK R ½ mile AB Mutual Dell	8/25/2016	3:26 PM	ND	ND	ND	31.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4994984	American Fork River BL Cave Camp Springs	8/24/2016	4:15 PM	ND	2.5	4.0	95.2	ND	ND	ND	ND	2.9	ND	ND	42.9	ND	2.2	ND	ND	ND	ND	ND	6.1
		8/25/2016	3:01 PM	ND	3.2	3.3	83.0	ND	ND	ND	ND	ND	ND	ND	30.3	ND	2.6	ND	ND	ND	ND	ND	ND
		8/26/2016	12:45 PM	ND	ND	2.9	78.6	ND	ND	ND	ND	ND	ND	ND	32.6	ND	2.1	ND	ND	ND	ND	ND	ND
		8/27/2016	10:05 AM	ND	10.0	3.7	77.0	ND	ND	ND	ND	ND	ND	ND	27.1	ND	3.6	ND	ND	ND	ND	ND	ND
		8/28/2016	9:35 AM	ND	ND	ND	71.1	ND	ND	ND	ND	ND	ND	ND	20.3	ND	ND	ND	ND	ND	ND	ND	ND
		8/30/2016	2:55 PM	ND	ND	ND	62.5	ND	ND	ND	ND	ND	ND	ND	9.7	ND	ND	ND	ND	ND	ND	ND	ND
4994980	American Fork River at mouth of Canyon	8/23/2016	12:25 PM	ND	4.2	3.9	84.2	ND	ND	ND	ND	ND	ND	ND	40.4	ND	2.6	ND	ND	ND	ND	ND	ND
		8/25/2016	2:42 PM	ND	2.5	2.9	78.1	ND	ND	ND	ND	ND	ND	ND	22.8	ND	ND	ND	ND	ND	ND	ND	ND
		8/26/2016	12:55 PM	ND	2.4	3.3	78.1	ND	ND	ND	ND	ND	ND	ND	25.2	ND	2.3	ND	ND	ND	ND	ND	ND
		8/27/2016	10:20 AM	ND	6.3	3.8	80.9	ND	ND	ND	ND	ND	ND	ND	28.7	ND	2.6	ND	ND	ND	ND	ND	ND
		8/28/2016	10:00 AM	ND	ND	2.4	72.7	ND	ND	ND	ND	ND	ND	ND	17.4	ND	ND	ND	ND	ND	ND	ND	ND
		8/30/2016	3:10 PM	ND	ND	ND	61.2	ND	ND	ND	ND	ND	ND	ND	9.0	ND	ND	ND	ND	ND	ND	ND	6.3
HGR	Highland Glen Reservoir	8/31/2016	3:30 PM	ND	ND	ND	50.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HP	Heritage Park		4:00 PM	ND	ND	ND	70.8	ND	ND	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	ND
MR	Manilla Reservoir		4:20 PM	ND	ND	3.8	65.0	ND	ND	ND	ND	ND	ND	ND	7.2	ND	ND	ND	ND	ND	ND	ND	ND

Aquatic Life Use (Dissolved Metals)

	No Exceedence		Above Screening Level																				
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			Utah Aquatic Life Use 1-hour	750		340			2	570		13	1000	65				468	18.4	1.6			120
			Utah Aquatic Life Use 4-hour	87		150			0.25	74		9	1000	2.5		0.012		52	4.6				120
Monitoring Location	Site Description	Collection Date	Collection Time	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
5912840	N FK American FK CK AB Tibble Fork Res	8/23/2016	2:25 PM	ND	ND	ND	42.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	7.9
		8/25/2016	4:35 PM	ND	ND	ND	40.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8
		8/26/2016	11:40 AM	ND	ND	ND	41.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8
		8/27/2016	8:55 AM	ND	ND	ND	42.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	11.3
		8/28/2016	8:40 AM	ND	ND	ND	41.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.8
		8/30/2016	2:10 PM	ND	ND	ND	40.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	7.8
5912830	Deer Creek AB Tibble Fork Res	8/25/2016	4:21 PM	ND	ND	ND	95.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	ND	ND	ND	ND	ND
5912810	N FK American FK R BL Tibble Fork Res	8/23/2016	2:45 PM	ND	4.1	7.9	148.0	ND	ND	ND	ND	ND	ND	ND	149.0	ND	3.2	ND	ND	ND	ND	ND	ND
		8/24/2016	4:25 PM	ND	4.2	6.5	130.0	ND	ND	ND	ND	ND	ND	ND	121.0	ND	2.9	ND	ND	ND	ND	ND	ND
		8/25/2016	4:08 PM	ND	2.6	5.2	111.0	ND	ND	ND	ND	ND	ND	ND	99.4	ND	2.7	ND	ND	ND	ND	ND	ND
		8/26/2016	11:17 AM	ND	2.1	5.4	112.0	ND	ND	ND	ND	ND	ND	ND	104.0	ND	2.6	ND	ND	ND	ND	ND	ND
		8/27/2016	9:27 AM	ND	3.1	5.4	109.0	ND	ND	ND	ND	ND	ND	ND	114.0	ND	3.0	ND	ND	ND	ND	ND	ND
		8/28/2016	9:00 AM	ND	ND	3.3	86.8	ND	ND	ND	ND	ND	ND	ND	55.7	ND	2.2	ND	ND	ND	ND	ND	ND
		8/30/2016	2:35 PM	ND	2.1	ND	58.7	ND	ND	ND	ND	ND	ND	ND	15.8	ND	2.5	ND	ND	ND	ND	ND	ND
4994990	N FK American FK R AB confl S FK	8/23/2016	3:00 PM	ND	4.4	6.0	120.0	ND	ND	ND	ND	ND	ND	ND	98.0	ND	3.1	ND	ND	ND	ND	ND	ND
		8/25/2016	3:48 PM	ND	3.4	4.8	105.0	ND	ND	ND	ND	ND	ND	ND	73.9	ND	2.7	ND	ND	ND	ND	ND	ND
		8/26/2016	12:20 PM	ND	2.5	5.3	107.0	ND	ND	ND	ND	ND	ND	ND	82.2	ND	2.7	ND	ND	ND	ND	ND	ND
		8/27/2016	9:45 AM	ND	3.3	4.3	95.6	ND	ND	ND	ND	ND	ND	ND	90.3	ND	3.1	ND	ND	ND	ND	ND	ND
		8/28/2016	9:20 AM	ND	ND	3.2	87.0	ND	ND	ND	ND	ND	ND	ND	48.6	ND	2.3	ND	ND	ND	ND	ND	ND
		8/30/2016	2:45 PM	ND	ND	2.0	62.7	ND	ND	ND	ND	ND	ND	ND	13.7	ND	2.3	ND	ND	ND	ND	ND	ND
4994983	S FK American FK R ½ mile AB Mutual Dell	8/25/2016	3:26 PM	ND	ND	ND	31.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4994984	American Fork River BL Cave Camp Springs	8/24/2016	4:15 PM	ND	2.5	4.0	95.2	ND	ND	ND	ND	2.9	ND	ND	42.9	ND	2.2	ND	ND	ND	ND	ND	6.1
		8/25/2016	3:01 PM	ND	3.2	3.3	83.0	ND	ND	ND	ND	ND	ND	ND	30.3	ND	2.6	ND	ND	ND	ND	ND	ND
		8/26/2016	12:45 PM	ND	ND	2.9	78.6	ND	ND	ND	ND	ND	ND	ND	32.6	ND	2.1	ND	ND	ND	ND	ND	ND
		8/27/2016	10:05 AM	ND	10.0	3.7	77.0	ND	ND	ND	ND	ND	ND	ND	27.1	ND	3.6	ND	ND	ND	ND	ND	ND
		8/28/2016	9:35 AM	ND	ND	ND	71.1	ND	ND	ND	ND	ND	ND	ND	20.3	ND	ND	ND	ND	ND	ND	ND	ND
		8/30/2016	2:55 PM	ND	ND	ND	62.5	ND	ND	ND	ND	ND	ND	ND	9.7	ND	ND	ND	ND	ND	ND	ND	ND
4994980	American Fork River at mouth of Canyon	8/23/2016	12:25 PM	ND	4.2	3.9	84.2	ND	ND	ND	ND	ND	ND	ND	40.4	ND	2.6	ND	ND	ND	ND	ND	ND
		8/25/2016	2:42 PM	ND	2.5	2.9	78.1	ND	ND	ND	ND	ND	ND	ND	22.8	ND	ND	ND	ND	ND	ND	ND	ND
		8/26/2016	12:55 PM	ND	2.4	3.3	78.1	ND	ND	ND	ND	ND	ND	ND	25.2	ND	2.3	ND	ND	ND	ND	ND	ND
		8/27/2016	10:20 AM	ND	6.3	3.8	80.9	ND	ND	ND	ND	ND	ND	ND	28.7	ND	2.6	ND	ND	ND	ND	ND	ND
		8/28/2016	10:00 AM	ND	ND	2.4	72.7	ND	ND	ND	ND	ND	ND	ND	17.4	ND	ND	ND	ND	ND	ND	ND	ND
		8/30/2016	3:10 PM	ND	ND	ND	61.2	ND	ND	ND	ND	ND	ND	ND	9.0	ND	ND	ND	ND	ND	ND	ND	6.3
HGR	Highland Glen Reservoir	8/31/2016	3:30 PM	ND	ND	ND	50.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HP	Heritage Park		4:00 PM	ND	ND	ND	70.8	ND	ND	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	ND
MR	Manilla Reservoir		4:20 PM	ND	ND	3.8	65.0	ND	ND	ND	ND	ND	ND	ND	7.2	ND	ND	ND	ND	ND	ND	ND	ND

Recreational Water Screening Values - Total Metals

Recreational Water (Total Metals)

No Exceedence | Above Screening Level

Monitoring Location	Site Description	Collection Date	Collection Time	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
		Recreational Screening Values		1,579,000	630	7,900	315,800	3,160	315,800	790	1,787,000	39,480	15,790		14,800	74,220	11,050	7,900	157,900	7,900	13,160	63	15,790	789,500
				ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MLID	Site Description	CollectionDate	CollectionTir	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
5912840	N FK American FK CK AB Tibble Fork Res	8/23/2016	2:25 PM	ND	ND	ND	41.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	6.2
		8/25/2016	4:35 PM	ND	ND	ND	41.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.8
		8/26/2016	11:40 AM	ND	ND	ND	40.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.4
		8/27/2016	8:55 AM	ND	ND	ND	41.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10.3
		8/28/2016	8:40 AM	ND	ND	ND	42.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10.0
		8/30/2016	2:10 PM	ND	ND	ND	42.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	7.5
5912830	Deer Creek AB Tibble Fork Res	8/25/2016	4:21 PM	ND	ND	ND	98.2	ND	ND	ND	ND	ND	ND	ND	ND	4.1	ND	2.6	ND	ND	ND	ND	ND	ND
5912810	N FK American FK R BL Tibble Fork Res	8/23/2016	2:45 PM	1,510.0	4.6	15.4	179.0	ND	ND	1.0	2.1	ND	9.5	3,500.0	83.0	279.0	ND	2.7	4.6	ND	ND	ND	ND	122.0
		8/24/2016	4:25 PM	2,370.0	5.0	13.9	165.0	ND	ND	0.9	2.6	ND	12.0	3,820.0	73.0	239.0	ND	2.5	5.2	ND	ND	ND	ND	106.0
		8/25/2016	4:08 PM	2,460.0	4.3	15.1	159.0	ND	ND	1.5	5.0	ND	18.7	5,730.0	115.0	305.0	ND	2.2	8.0	ND	ND	ND	5.0	170.0
		8/26/2016	11:17 AM	1,040.0	3.0	9.3	130.0	ND	ND	0.6	ND	ND	7.7	2,410.0	45.5	174.0	ND	2.5	3.4	ND	ND	ND	ND	65.1
		8/27/2016	9:27 AM	ND	2.9	10.0	142.0	ND	ND	0.9	2.6	ND	9.7	ND	53.2	221.0	ND	2.3	4.4	ND	ND	ND	ND	79.9
		8/28/2016	9:00 AM	ND	2.5	8.3	102.0	ND	ND	0.9	ND	ND	8.2	ND	60.5	136.0	ND	ND	3.2	ND	ND	ND	ND	78.9
		8/30/2016	2:35 PM	1,010.0	2.4	3.5	72.7	ND	ND	ND	ND	ND	3.9	1,300.0	19.1	57.2	ND	2.4	ND	ND	ND	ND	ND	36.2
4994990	N FK American FK R AB confl S FK	8/23/2016	3:00 PM	7,780.0	6.3	28.3	295.0	ND	ND	3.9	11.2	8.2	40.1	15,700.0	296.0	779.0	0.3	2.1	21.4	ND	ND	ND	14.6	475.0
		8/25/2016	3:48 PM	6,790.0	6.5	28.3	350.0	ND	ND	4.4	13.6	9.4	41.8	17,200.0	317.0	907.0	0.3	ND	23.6	ND	ND	ND	13.4	538.0
		8/26/2016	12:20 PM	2,080.0	3.8	14.0	161.0	ND	ND	1.4	3.4	ND	14.8	5,560.0	106.0	353.0	ND	2.2	8.0	ND	ND	ND	ND	173.0
		8/27/2016	9:45 AM	ND	5.3	31.2	275.0	ND	ND	5.0	12.7	9.1	59.9	ND	364.0	773.0	0.3	ND	23.6	ND	ND	ND	ND	574.0
		8/28/2016	9:20 AM	ND	2.6	9.2	119.0	ND	ND	1.0	2.6	ND	10.5	ND	72.6	194.0	ND	ND	4.7	ND	ND	ND	ND	112.0
		8/30/2016	2:45 PM	1,570.0	ND	5.3	89.7	ND	ND	0.6	2.9	ND	6.5	2,490.0	37.4	113.0	ND	2.1	3.6	ND	ND	ND	ND	69.0
4994983	S FK American FK R ½ mile AB Mutual Dell	8/25/2016	3:26 PM	ND	ND	ND	31.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4994984	American Fork River BL Cave Camp Springs	8/9/2016	4:30 PM	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	NS	ND	NS	ND	NS	NS	NS	NS	NS	NS	ND
		8/22/2016	3:50 PM	NS	12.4	276.0	NS	8.3	NS	76.8	94.9	NS	781.0	NS	5,610.0	NS	4.3	NS	221.0	3.5	25.9	2.5	NS	8,050.0
		8/24/2016	4:15 PM	2,610.0	3.8	12.0	138.0	ND	ND	1.3	3.2	ND	14.7	5,310.0	93.7	217.0	ND	ND	6.7	ND	ND	ND	5.4	154.0
		8/25/2016	3:01 PM	2,920.0	4.7	14.4	147.0	ND	ND	2.0	6.2	ND	23.8	6,210.0	138.0	275.0	0.2	2.1	9.1	ND	ND	ND	6.2	223.0
		8/26/2016	12:45 PM	1,430.0	3.2	9.4	112.0	ND	ND	1.0	2.4	ND	10.6	3,620.0	76.2	189.0	ND	ND	5.2	ND	ND	ND	ND	124.0
		8/27/2016	10:05 AM	ND	11.5	92.6	418.0	2.2	ND	22.0	25.9	22.2	246.0	ND	1,640.0	1,540.0	1.2	ND	55.1	ND	8.0	ND	ND	2,270.0
		8/28/2016	9:35 AM	ND	ND	6.5	99.9	ND	ND	0.9	2.2	ND	8.7	ND	59.5	147.0	ND	ND	4.4	ND	ND	ND	ND	92.3
		8/30/2016	2:55 PM	4,300.0	ND	6.9	119.0	ND	ND	0.9	10.2	ND	12.5	5,040.0	49.0	231.0	ND	ND	8.3	ND	ND	ND	9.0	96.1
4994980	American Fork River at mouth of Canyon	8/23/2016	12:25 PM	3,450.0	6.1	19.8	155.0	ND	ND	3.1	5.2	4.6	26.6	7,510.0	231.0	423.0	0.4	ND	10.2	ND	ND	ND	7.7	341.0
		8/25/2016	2:42 PM	1,270.0	3.6	8.0	103.0	ND	ND	0.9	2.4	ND	9.8	3,000.0	65.7	133.0	ND	ND	4.2	ND	ND	ND	ND	108.0
		8/26/2016	12:55 PM	935.0	3.0	8.5	100.0	ND	ND	1.0	ND	ND	9.3	2,780.0	76.2	173.0	0.2	ND	4.1	ND	ND	ND	ND	116.0
		8/27/2016	10:20 AM	ND	9.2	50.0	290.0	ND	ND	10.8	18.2	13.0	131.0	ND	795.0	948.0	0.6	ND	36.7	ND	3.9	ND	ND	1,140.0
		8/28/2016	10:00 AM	ND	2.2	7.7	103.0	ND	ND	1.0	2.8	ND	10.4	ND	68.9	161.0	ND	ND	5.5	ND	ND	ND	ND	114.0
		8/30/2016	3:10 PM	2,550.0	ND	6.6	93.3	ND	ND	0.8	4.5	ND	9.7	3,580.0	52.5	151.0	ND	ND	4.9	ND	ND	ND	5.3	90.5
HGR	Highland Glen Reservoir	8/31/2016	3:30 PM	318.0	2.3	2.4	51.7	ND	ND	ND	ND	ND	ND	412.0	ND	19.5	ND	2.1	ND	ND	ND	ND	ND	ND
HP	Heritage Park		4:00 PM	119.0	ND	ND	73.8	ND	ND	ND	ND	ND	ND	104.0	ND	7.6	ND	ND	ND	ND	ND	ND	ND	6.1
MR	Manilla Reservoir		4:20 PM	144.0	ND	3.7	68.1	ND	ND	ND	ND	ND	ND	139.0	ND	34.1	ND	ND	ND	ND	ND	ND	ND	ND

Comparison of American Fork River Raw Water Data with Screening Values for Agricultural Uses (Stock watering and Irrigation) – Dissolved Metals

The dissolved water concentrations of metals and metalloids were compared to screening values, including Utah's water quality standards for the Class 4 protected for agricultural uses including irrigation of crops and stock watering. Results are below the screening values for all metals and metalloids.

Agricultural Water (Dissolved Metals)

No Exceedence | Above Screening Level

				Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Selenium	Silver	Sodium	Thallium	Total Dissolved Solids	Vanadium	Zinc
Livestock Water Screening Value				5,000		200				50	500	1,000	1,000	500		100	250,000		10			50		1,000,000		1,200	100	25,000
Irrigation Water Short-Term				20,000		2,000				50		1,000	5,000	5,000	20,000	10,000		10,000		50	2,000	20					1,000	10,000
Irrigation Water Long-Term				5,000		100				10		100	50	200	5,000	5,000		200		10	200	20				500,000	100	2,000
Utah DWQ Agriculutral Use Criteria						100			750	10		100		200		100						50				1,200		
Monitoring Location	Site Description	Collection Date	Collection Time	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	ug/L	mg/L	ug/L	ug/L
5912840	N FK American FK CK AB Tibble Fork Res	8/23/2016	2:25 PM	ND	ND	ND	42.3	ND	ND	ND	74.9	ND	ND	ND	ND	ND	23.5	ND	ND	2.1	ND	ND	ND	2.6	ND	NS	ND	7.9
		8/25/2016	4:35 PM	ND	ND	ND	40.6	ND	ND	ND	83.7	ND	ND	ND	ND	ND	25.1	ND	ND	ND	ND	ND	ND	NS	ND	368.0	ND	6.8
		8/26/2016	11:40 AM	ND	ND	ND	41.1	ND	ND	ND	79.9	ND	ND	ND	ND	ND	25.9	ND	ND	ND	ND	ND	ND	NS	ND	336.0	ND	6.8
		8/27/2016	8:55 AM	ND	ND	ND	42.4	ND	ND	ND	79.6	ND	ND	ND	ND	ND	26.2	ND	ND	2.1	ND	ND	ND	NS	ND	332.0	ND	11.3
		8/28/2016	8:40 AM	ND	ND	ND	41.0	ND	ND	ND	78.0	ND	ND	ND	ND	ND	25.4	ND	ND	ND	ND	ND	ND	NS	ND	336.0	ND	6.8
		8/30/2016	2:10 PM	ND	ND	ND	40.9	ND	ND	ND	79.4	ND	ND	ND	ND	ND	25.7	ND	ND	2.1	ND	ND	ND	2.7	ND	272.0	ND	7.8
5912830	Deer Creek AB Tibble Fork Res	8/25/2016	4:21 PM	ND	ND	ND	95.4	ND	ND	ND	52.3	ND	ND	ND	ND	ND	6.8	ND	ND	2.5	ND	ND	ND	NS	ND	124.0	ND	ND
5912810	N FK American FK R BL Tibble Fork Res	8/23/2016	2:45 PM	ND	4.1	7.9	148.0	ND	ND	ND	67.3	ND	ND	ND	ND	ND	19.5	149.0	ND	3.2	ND	ND	ND	2.7	ND	NS	ND	ND
		8/24/2016	4:25 PM	ND	4.2	6.5	130.0	ND	ND	ND	70.0	ND	ND	ND	ND	ND	19.4	121.0	ND	2.9	ND	ND	ND	2.6	ND	NS	ND	ND
		8/25/2016	4:08 PM	ND	2.6	5.2	111.0	ND	ND	ND	75.9	ND	ND	ND	ND	ND	18.9	99.4	ND	2.7	ND	ND	ND	NS	ND	296.0	ND	ND
		8/26/2016	11:17 AM	ND	2.1	5.4	112.0	ND	ND	ND	71.6	ND	ND	ND	ND	ND	19.1	104.0	ND	2.6	ND	ND	ND	NS	ND	240.0	ND	ND
		8/27/2016	9:27 AM	ND	3.1	5.4	109.0	ND	ND	ND	72.2	ND	ND	ND	ND	ND	20.7	114.0	ND	3.0	ND	ND	ND	NS	ND	312.0	ND	ND
		8/28/2016	9:00 AM	ND	ND	3.3	86.8	ND	ND	ND	75.6	ND	ND	ND	ND	ND	22.8	55.7	ND	2.2	ND	ND	ND	NS	ND	344.0	ND	ND
		8/30/2016	2:35 PM	ND	2.1	ND	58.7	ND	ND	ND	70.9	ND	ND	ND	ND	ND	20.6	15.8	ND	2.5	ND	ND	ND	2.9	ND	292.0	ND	ND
4994990	N FK American FK R AB confl S FK	8/23/2016	3:00 PM	ND	4.4	6.0	120.0	ND	ND	ND	63.3	ND	ND	ND	ND	ND	17.7	98.0	ND	3.1	ND	ND	ND	2.7	ND	NS	ND	ND
		8/25/2016	3:48 PM	ND	3.4	4.8	105.0	ND	ND	ND	69.6	ND	ND	ND	ND	ND	18.2	73.9	ND	2.7	ND	ND	ND	NS	ND	260.0	ND	ND
		8/26/2016	12:20 PM	ND	2.5	5.3	107.0	ND	ND	ND	69.4	ND	ND	ND	ND	ND	18.6	82.2	ND	2.7	ND	ND	ND	NS	ND	272.0	ND	ND
		8/27/2016	9:45 AM	ND	3.3	4.3	95.6	ND	ND	ND	65.5	ND	ND	ND	ND	ND	17.7	90.3	ND	3.1	ND	ND	ND	NS	ND	260.0	ND	ND
		8/28/2016	9:20 AM	ND	ND	3.2	87.0	ND	ND	ND	70.9	ND	ND	ND	ND	ND	20.6	48.6	ND	2.3	ND	ND	ND	NS	ND	328.0	ND	ND
		8/30/2016	2:45 PM	ND	ND	2.0	62.7	ND	ND	ND	70.9	ND	ND	ND	ND	ND	21.0	13.7	ND	2.3	ND	ND	ND	2.7	ND	296.0	ND	ND
4994983	S FK American FK R ½ mile AB Mutual Dell	8/25/2016	3:26 PM	ND	ND	ND	31.5	ND	ND	ND	52.2	ND	ND	ND	ND	ND	9.0	ND	ND	ND	ND	ND	ND	NS	ND	108.0	ND	ND
4994984	American Fork River BL Cave Camp Springs	8/9/2016	4:30 PM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	232.0	NS	NS
		8/22/2016	3:50 PM	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	280.0	NS	NS
		8/24/2016	4:15 PM	ND	2.5	4.0	95.2	ND	ND	ND	65.5	ND	ND	2.9	ND	ND	17.5	42.9	ND	2.2	ND	ND	ND	4.4	ND	NS	ND	6.1
		8/25/2016	3:01 PM	ND	3.2	3.3	83.0	ND	ND	ND	69.2	ND	ND	ND	ND	ND	17.8	30.3	ND	2.6	ND	ND	ND	NS	ND	276.0	ND	ND
		8/26/2016	12:45 PM	ND	ND	2.9	78.6	ND	ND	ND	68.6	ND	ND	ND	ND	ND	17.9	32.6	ND	2.1	ND	ND	ND	NS	ND	252.0	ND	ND
		8/27/2016	10:05 AM	ND	10.0	3.7	77.0	ND	ND	ND	63.5	ND	ND	ND	ND	ND	18.9	27.1	ND	3.6	ND	ND	ND	NS	ND	248.0	ND	ND
		8/28/2016	9:35 AM	ND	ND	ND	71.1	ND	ND	ND	68.2	ND	ND	ND	ND	ND	19.6	20.3	ND	ND	ND	ND	ND	NS	ND	264.0	ND	ND
		8/30/2016	2:55 PM	ND	ND	ND	62.5	ND	ND	ND	67.9	ND	ND	ND	ND	ND	19.5	9.7	ND	ND	ND	ND	ND	4.9	ND	248.0	ND	ND
4994980	American Fork River at mouth of Canyon	8/23/2016	12:25 PM	ND	4.2	3.9	84.2	ND	ND	ND	64.9	ND	ND	ND	ND	ND	18.1	40.4	ND	2.6	ND	ND	ND	5.5	ND	NS	ND	ND
		8/25/2016	2:42 PM	ND	2.5	2.9	78.1	ND	ND	ND	70.8	ND	ND	ND	ND	ND	19.1	22.8	ND	ND	ND	ND	ND	NS	ND	216.0	ND	ND
		8/26/2016	12:55 PM	ND	2.4	3.3	78.1	ND	ND	ND	70.6	ND	ND	ND	ND	ND	20.3	25.2	ND	2.3	ND	ND	ND	NS	ND	204.0	ND	ND
		8/27/2016	10:20 AM	ND	6.3	3.8	80.9	ND	ND	ND	68.1	ND	ND	ND	ND	ND	20.0	28.7	ND	2.6	ND	ND	ND	NS	ND	272.0	ND	ND
		8/28/2016	10:00 AM	ND	ND	2.4	72.7	ND	ND	ND	69.7	ND	ND	ND	ND	ND	20.1	17.4	ND	ND	ND	ND	ND	NS	ND	280.0	ND	ND
		8/30/2016	3:10 PM	ND	ND	ND	61.2	ND	ND	ND	67.9	ND	ND	ND	ND	ND	19.2	9.0	ND	ND	ND	ND	ND	4.8	ND	288.0	ND	6.3
HGR	Highland Glen Reservoir	8/31/2016	3:30 PM	ND	ND	ND	50.3	ND	ND	ND	52.8	ND	ND	ND	ND	ND	16.7	ND	ND	ND	ND	ND	ND	5.7	ND	220.0	ND	ND
HP	Heritage Park		4:00 PM	ND	ND	ND	70.8	ND	ND	ND	63.0	ND	ND	ND	ND	ND	23.5	3.2	ND	ND	ND	ND	ND	7.6	ND	332.0	ND	ND
MR	Manilla Reservoir		4:20 PM	ND	ND	3.8	65.0	ND	ND	ND	46.9	ND	ND	ND	ND	ND	11.2	7.2	ND	ND	ND	ND	ND	11.1	ND	212.0	ND	ND

Sediment Screening Analysis

Summary

The Utah Department of Environmental Quality (DEQ) collected sediment samples from four sites on August 23, 2016 (Table 1). The sampling locations were selected in the field to be more likely representative of depositional environments in the river.

At each site, samples were collected from recent depositional areas along the stream bank and were observed to be deposited during the Tibble Fork release. Samples were collected from the top (approximately) 2 cm of sediment. Sediments were analyzed for metals and metalloids and are reported in dry weight concentrations. The Screening Analysis table compares the sediment concentrations to human health-based screening values for soil because sediment-specific screening values are unavailable. The table also compares the sediment concentrations to aquatic life screening values.

The screening-level analyses show that sediment lead concentrations were above the health-based screening values for soil. All other metal concentrations were below screening values. However, some sediment metal concentrations indicate an upward trend moving downstream from Tibble Fork Reservoir. Lead and arsenic, two metals known to be present in high concentrations in Tibble Fork Reservoir sediments, show a similar trend, both showing significant increase in concentration moving downstream from the reservoir. The highest concentrations are observed in the North Fork of the American Fork River above the South Fork confluence. This site was observed to have higher rates of deposition and the elevated concentrations are likely caused by higher rates of accumulation.

Sediment Screening – Dry Weight Sediment

Screening Values

Health-based screening values are taken from the Agency for Toxic Substance and Disease Registry (ATSDR). As is most appropriate for recreational exposures, ATSDR Environmental Media Evaluation Guideline (EMEG) health-based child intermediate exposure (>14 days up to one year) comparison values, were chosen first if available, followed by ATSDR EMEG health-based child chronic exposure (>1 year) comparison values. In the absence of EMEGs, ATSDR child Reference Dose Media Evaluation Guidelines (RMEGs), based upon EPA RfDs, were used. In the absence of RMEGs, EPA risk-based Regional Screening Levels (RSLs) were used.

Aquatic life screening values come from EPA Region 3 and are considered to be benchmarks protective of aquatic life uses (EPA Freshwater Sediment Screening Benchmarks 2006).

Table 3. Sediment Screening Values

CAS	Chemical	Units	Health-Based Comparison Value for Sediment Ingestion (CV) [Total Metals]	EPA Region 3 Freshwater Sediment Screening Values for Aquatic Life
7429-90-5	Aluminum	mg/kg	165,428	
7440-36-0	Antimony	mg/kg	66	
7440-38-2	Arsenic	mg/kg	753	9.80
7440-39-3	Barium	mg/kg	33,086	
7440-41-7	Beryllium	mg/kg	331	
7440-43-9	Cadmium	mg/kg	87	0.99
7440-47-3	Chromium	mg/kg	213,402	43.40
7440-48-4	Cobalt	mg/kg	1,654	50.00
7440-50-8	Copper	mg/kg	1,654	31.60
7439-89-6	Iron	mg/kg	115,799	20000.00
7439-92-1	Lead	mg/kg	400	35.80
7439-96-5	Manganese	mg/kg	7,775	460.00
7439-97-6	Mercury	mg/kg	1,158	0.18
7440-02-0	Nickel	mg/kg	3,309	22.70
7782-49-2	Selenium	mg/kg	827	2.00
7440-22-4	Silver	mg/kg	827	1.00
7440-62-2	Vanadium	mg/kg	1,654	
7440-66-6	Zinc	mg/kg	49,628	121.00

Comparison of American Fork River Sediment Data to Human Health Screening Values

Sediment concentrations below Tibble Fork Reservoir exceed human health screening values for lead. Sediment concentrations for arsenic, cadmium, lead, manganese, and zinc exceeded freshwater aquatic life screening values both above and below Tibble Fork Reservoir on August 23, 2016. The concentrations are notably higher (2 to 7 times) below the reservoir compared to samples above the reservoir.

Table 4. Human Health Comparison Value Screening.

No Exceedence	Above Screening Level																						
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Molybdenum
Health Based Comparison Values for Recreation				165,428	66	753	33,086	331	87	213,402	1,654	1,654	115,799	400	7,775	1,158	3,309	827	827	1,654	49,628	827
Monitoring Location	Site Description	Collection Date	Collection Time	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
5912840	N FK American FK CK AB Tibble Fork Res	8/23/2016	2:25:00 PM	6,840	ND	13	60	ND	2	20	5	ND	17,300	40	466	0	21	ND	ND	26	213	ND
		8/27/2016	8:55:00 AM	11,000	ND	17	54	ND	2	22	9	ND	18,900	70	563	ND	24	ND	ND	24	207	ND
		8/28/2016	8:40:00 AM	10,300	ND	13	38	ND	2	26	7	ND	29,600	43	471	0	21	ND	ND	27	265	ND
5912810	N FK American FK R BL Tibble Fork Res	8/23/2016	2:45:00 PM	7,760	ND	16	181	ND	2	22	6	ND	12,100	109	406	0	ND	ND	ND	35	280	ND
		8/27/2016	9:27:00 AM	7,540	5	19	178	ND	2	17	6	23	23,900	114	442	0	ND	ND	ND	22	306	ND
		8/28/2016	9:00:00 AM	7,950	ND	18	137	ND	2	16	6	20	25,000	105	391	0	ND	ND	ND	21	262	ND
4994990	N FK American FK R AB confl S FK	8/23/2016	3:00:00 PM	11,700	9	34	162	ND	5	26	9	56	15,700	347	560	0	ND	ND	ND	42	601	ND
		8/27/2016	9:45:00 AM	8,800	ND	20	158	ND	2	18	6	25	26,800	128	471	0	ND	ND	ND	22	342	ND
		8/28/2016	9:20:00 AM	10,000	ND	21	181	ND	3	19	7	25	28,300	154	491	0	ND	ND	ND	23	370	ND
4994984 - b	American Fork River BL Cave Camp Springs - Blw Water Line	9/1/2016	12:18:00 PM	NS	10	39	NS	0	6	23	NS	66	NS	415	NS	0	30	0	0	NS	650	NS
4994984 - a	American Fork River BL Cave Camp Springs - Abv Water Line		12:18:00 PM	NS	0	22	NS	0	3	21	NS	33	NS	163	NS	0	0	0	0	NS	339	NS
4994984	American Fork River BL Cave Camp Springs	8/27/2016	10:05:00 AM	7,660	4	19	139	ND	2	15	6	20	24,300	128	483	0	ND	ND	ND	19	321	ND
		8/28/2016	9:35:00 AM	9,360	ND	15	107	ND	2	18	5	20	21,300	93	357	0	ND	ND	ND	24	235	ND
4994980	American Fork River at mouth of Canyon	8/23/2016	12:25:00 PM	12,900	7	31	155	ND	4	26	9	43	18,400	267	576	0	26	ND	ND	38	509	ND
		8/27/2016	10:20:00 AM	16,600	12	49	180	ND	8	30	13	92	41,000	522	616	1	36	ND	3	38	916	ND
		8/28/2016	10:00:00 AM	9,560	ND	22	116	ND	3	18	7	31	23,100	170	440	0	ND	ND	ND	22	351	ND

Comparison of American Fork River Sediment Data to Aquatic Life Screening Values

Concentrations of copper were not detected above the reservoir but exceed the aquatic life screening value below the reservoir. Further assessments are required to determine if metal contamination in sediments has had an impact on the biological community in the system. The Division of Wildlife Resources has found an intact benthic macroinvertebrate community above the reservoir and in the lower portion of American Fork River, below the reservoir confluence with the South Fork. The macroinvertebrate community in the two mile stretch directly below Tibble Fork Reservoir appeared to be heavily impacted by the sediment release. This is the same stretch that experienced a fish kill in between August 19 and August 22.

Table 5. Aquatic Life Use Screening Values

	No Exceedence		Above Screening Level																				
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc	Molybdenum
			EPA Aquatic Life Screening Values			9.8			1.0	43.4	50.0	31.6	20,000.0	35.8	460.0	0.2	22.7	2.0	1.0		121.0	
Monitoring Location	Site Description	Collection Date	Collection Time	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
5912840	N FK American FK CK AB Tibble Fork Res	8/23/2016	2:25:00 PM	6,840	ND	13	60	ND	2	20	5	ND	17,300	40	466	0.1	21	ND	ND	26	213	ND
		8/27/2016	8:55:00 AM	11,000	ND	17	54	ND	2	22	9	ND	18,900	70	563	ND	24	ND	ND	24	207	ND
		8/28/2016	8:40:00 AM	10,300	ND	13	38	ND	2	26	7	ND	29,600	43	471	0.1	21	ND	ND	27	265	ND
5912810	N FK American FK R BL Tibble Fork Res	8/23/2016	2:45:00 PM	7,760	ND	16	181	ND	2	22	6	ND	12,100	109	406	0.2	ND	ND	ND	35	280	ND
		8/27/2016	9:27:00 AM	7,540	5	19	178	ND	2	17	6	23	23,900	114	442	0.2	ND	ND	ND	22	306	ND
		8/28/2016	9:00:00 AM	7,950	ND	18	137	ND	2	16	6	20	25,000	105	391	0.2	ND	ND	ND	21	262	ND
4994990	N FK American FK R AB confl S FK	8/23/2016	3:00:00 PM	11,700	9	34	162	ND	5	26	9	56	15,700	347	560	0.4	ND	ND	ND	42	601	ND
		8/27/2016	9:45:00 AM	8,800	ND	20	158	ND	2	18	6	25	26,800	128	471	0.2	ND	ND	ND	22	342	ND
		8/28/2016	9:20:00 AM	10,000	ND	21	181	ND	3	19	7	25	28,300	154	491	0.2	ND	ND	ND	23	370	ND
4994984 - b	American Fork River BL Cave Camp Springs - Blw Water Line	9/1/2016	12:18:00 PM	NS	10	39	NS	0	6	23	NS	66	NS	415	NS	0.5	30	0	0	NS	650	NS
4994984 - a	American Fork River BL Cave Camp Springs - Abv Water Line		12:18:00 PM	NS	0	22	NS	0	3	21	NS	33	NS	163	NS	0.2	0	0	0	NS	339	NS
4994984	American Fork River BL Cave Camp Springs	8/27/2016	10:05:00 AM	7,660	4	19	139	ND	2	15	6	20	24,300	128	483	0.2	ND	ND	ND	19	321	ND
		8/28/2016	9:35:00 AM	9,360	ND	15	107	ND	2	18	5	20	21,300	93	357	0.1	ND	ND	ND	24	235	ND
4994980	American Fork River at mouth of Canyon	8/23/2016	12:25:00 PM	12,900	7	31	155	ND	4	26	9	43	18,400	267	576	0.3	26	ND	ND	38	509	ND
		8/27/2016	10:20:00 AM	16,600	12	49	180	ND	8	30	13	92	41,000	522	616	0.6	36	ND	3	38	916	ND
		8/28/2016	10:00:00 AM	9,560	ND	22	116	ND	3	18	7	31	23,100	170	440	0.3	ND	ND	ND	22	351	ND

Sediment Screening Values – Dry Weight Sediment

The figures below provide a comparison between the sediment data above and below Tibble Fork Reservoir. Concentrations of Arsenic, in addition to exceeding human health and aquatic life screening values are three times higher in downstream samples when compared to upstream samples.

Concentrations of arsenic, cadmium, copper, lead, nickel, and zinc are 2 to 10 times higher in samples below the reservoir when compared with upstream samples. Samples of any metals exceed freshwater aquatic life screening values both above and below Tibble Fork Reservoir.

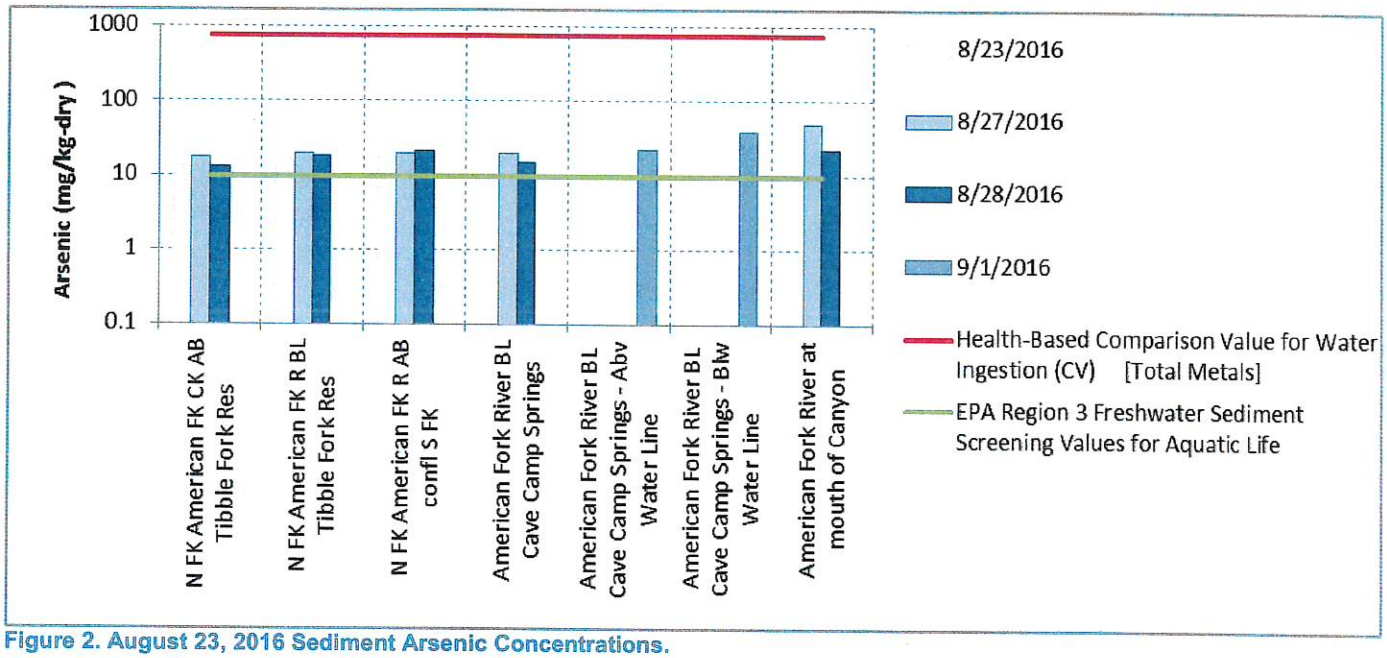


Figure 2. August 23, 2016 Sediment Arsenic Concentrations.

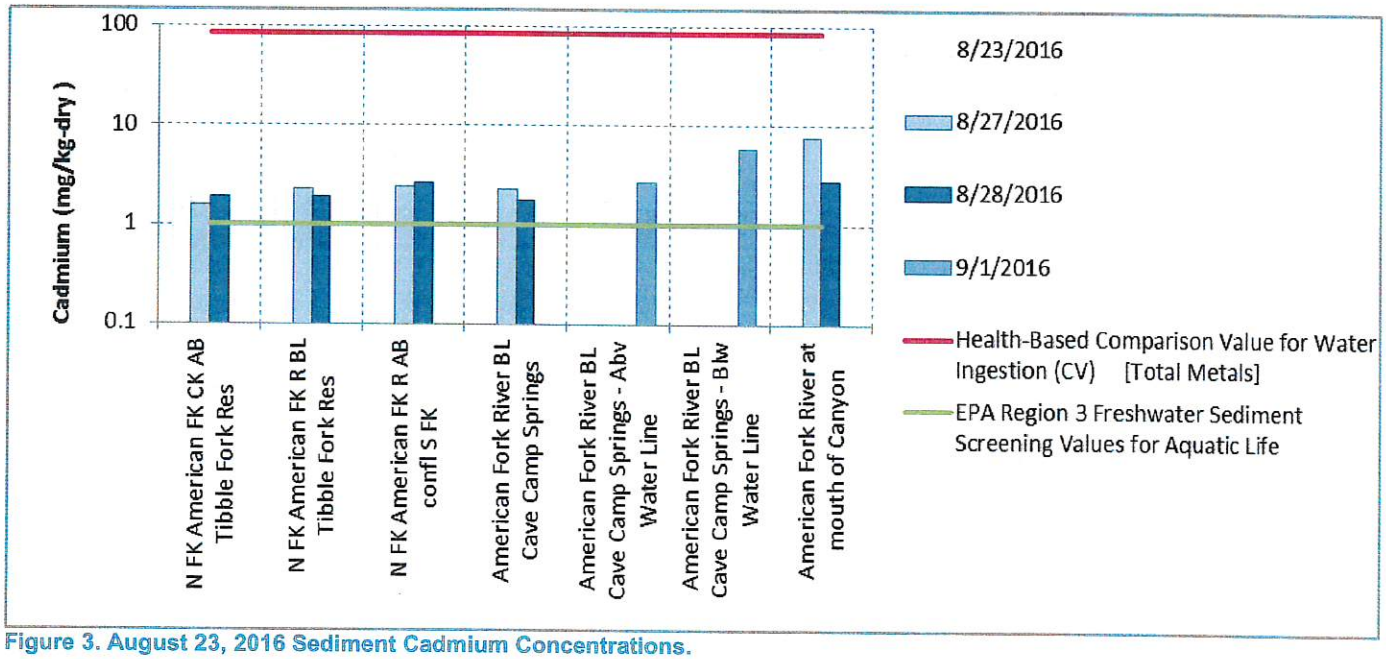


Figure 3. August 23, 2016 Sediment Cadmium Concentrations.

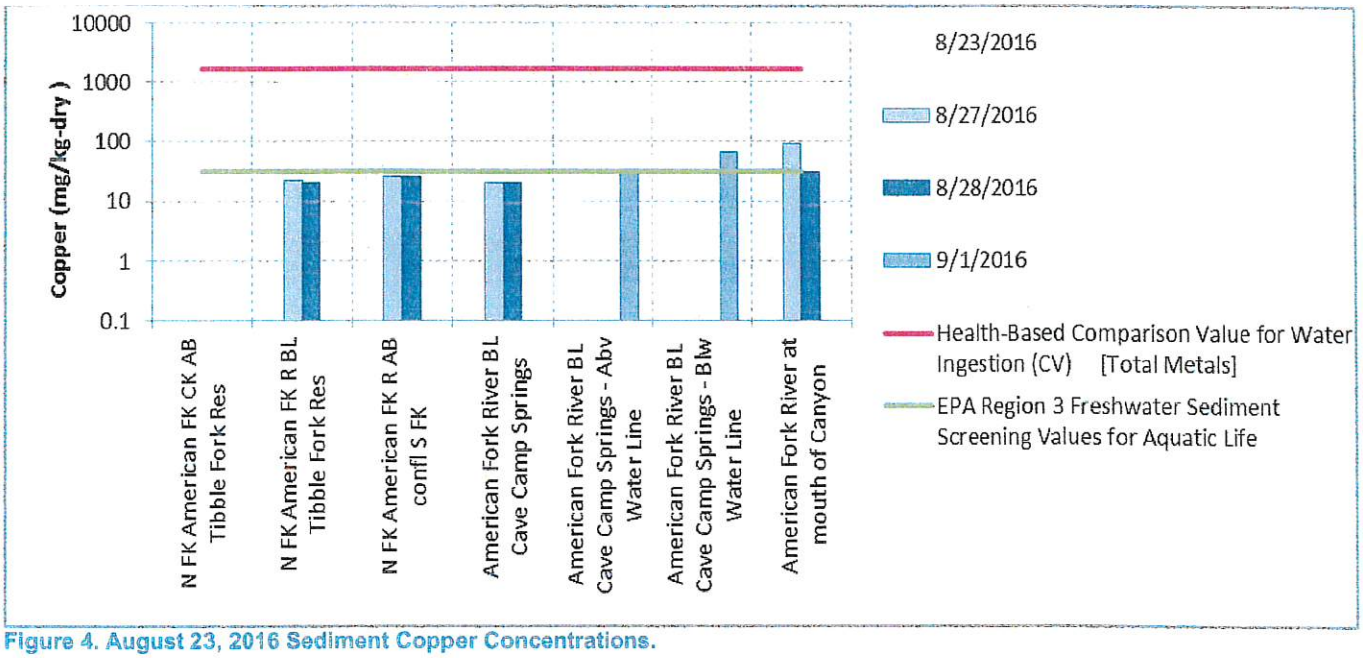


Figure 4. August 23, 2016 Sediment Copper Concentrations.

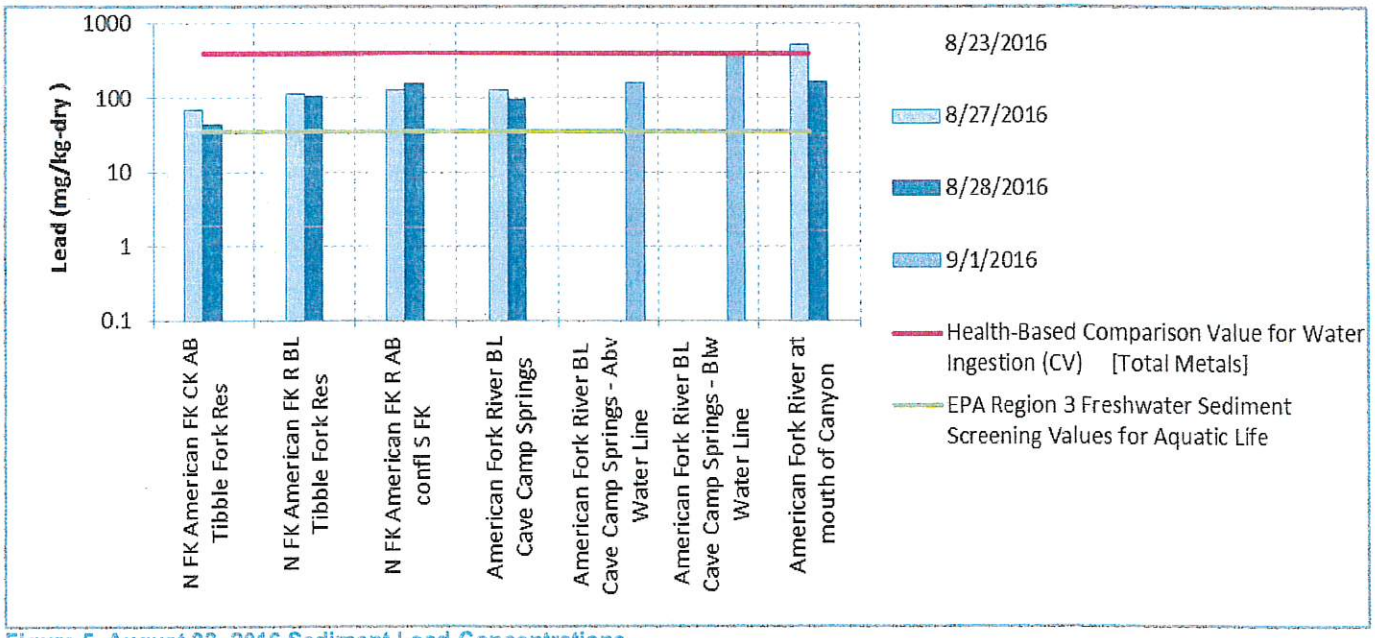


Figure 5. August 23, 2016 Sediment Lead Concentrations.

Sediment Screening Values – Dry Weight Sediment

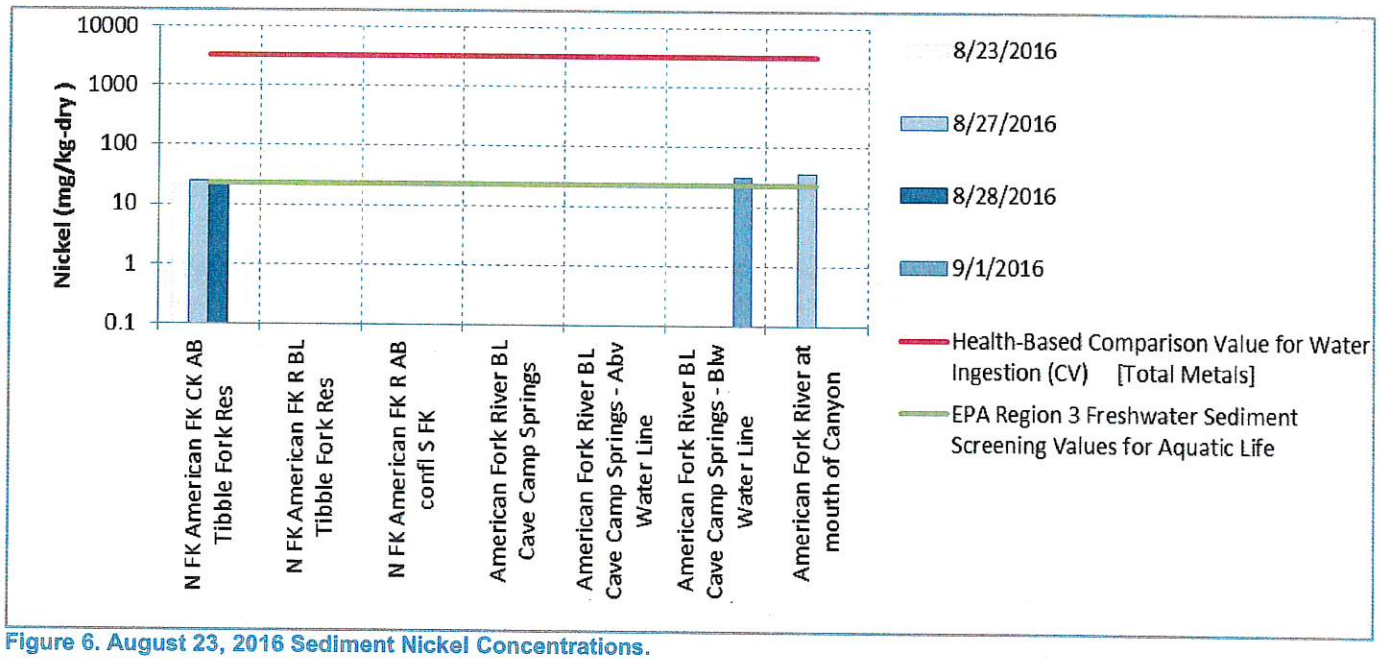


Figure 6. August 23, 2016 Sediment Nickel Concentrations.

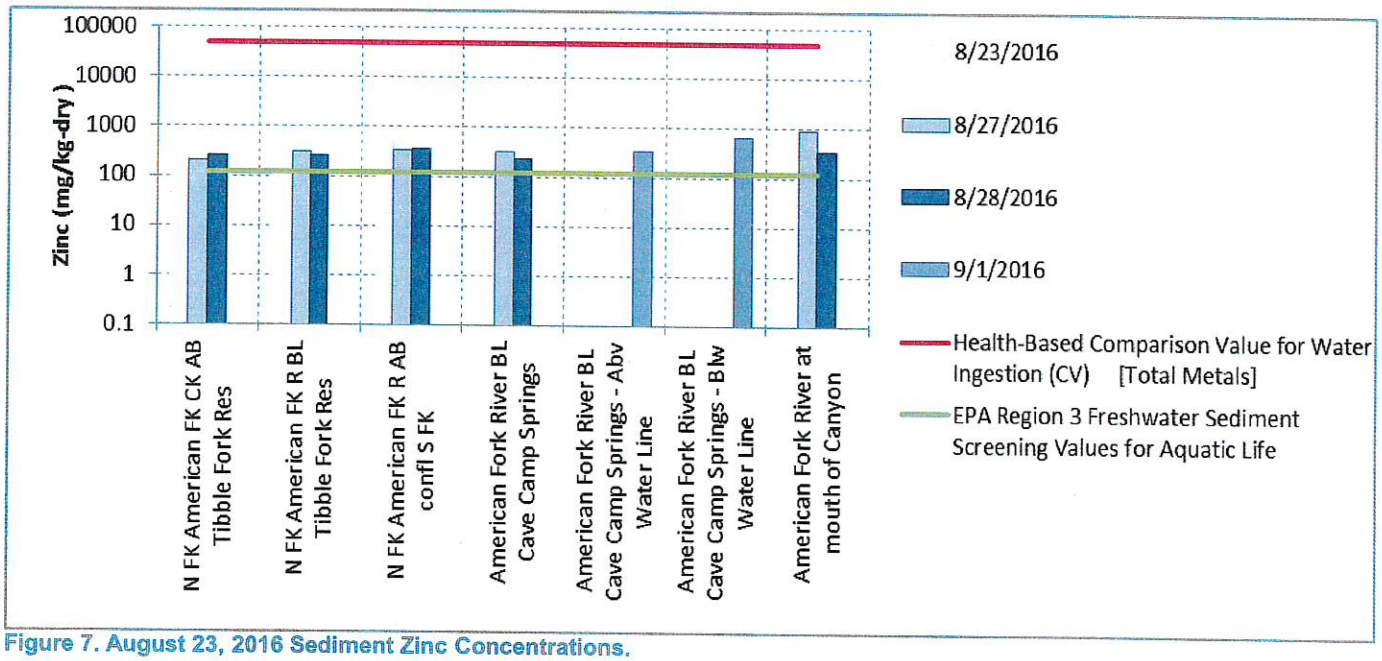


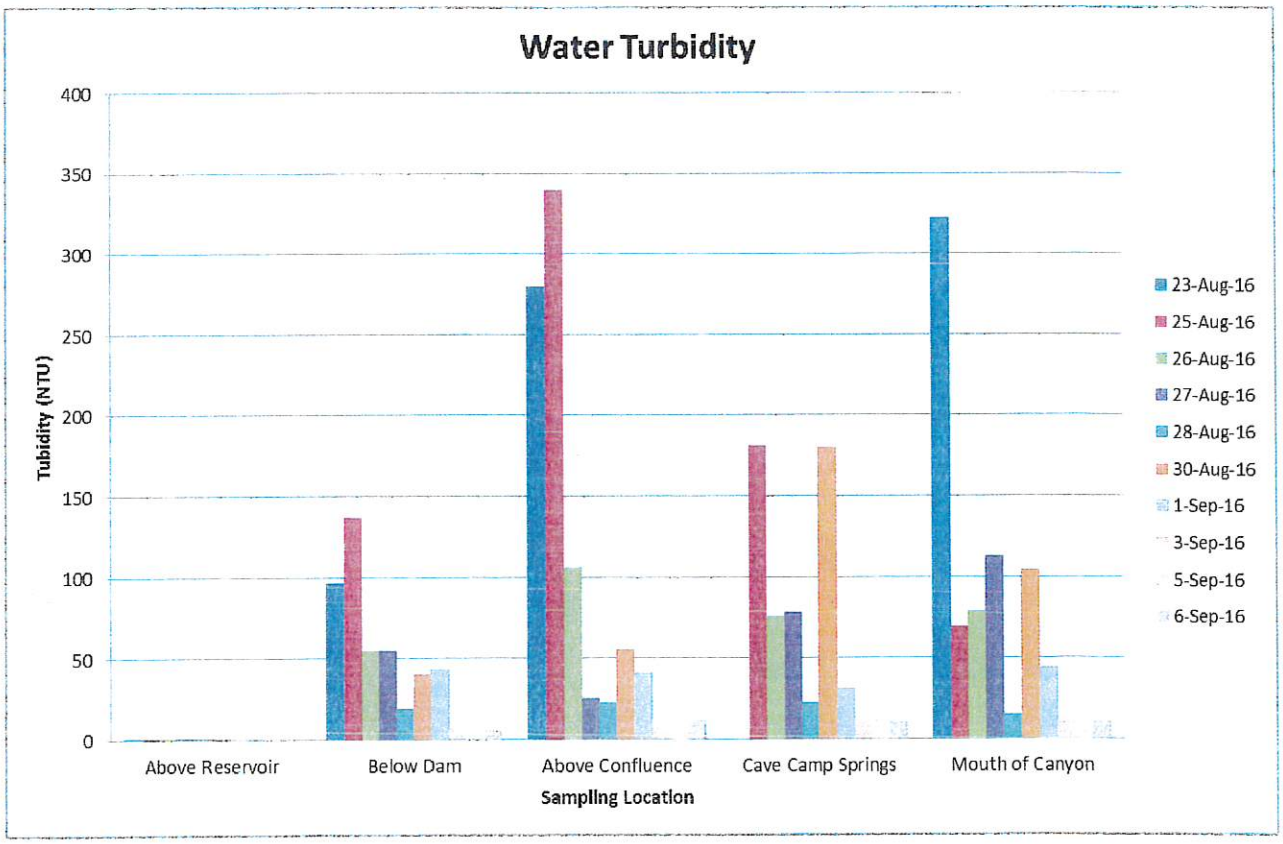
Figure 7. August 23, 2016 Sediment Zinc Concentrations.

Water Column Turbidity and Suspended Solids

Visual inspections and pictures of the American Fork River downstream of Tibble Fork Reservoir shortly after the discharge showed that the water was dark and full of sediment. Since then, water samples have been collected almost daily by the Division of Water Quality and other agencies in order to document and track the impact of the sediment on the water quality of the river.

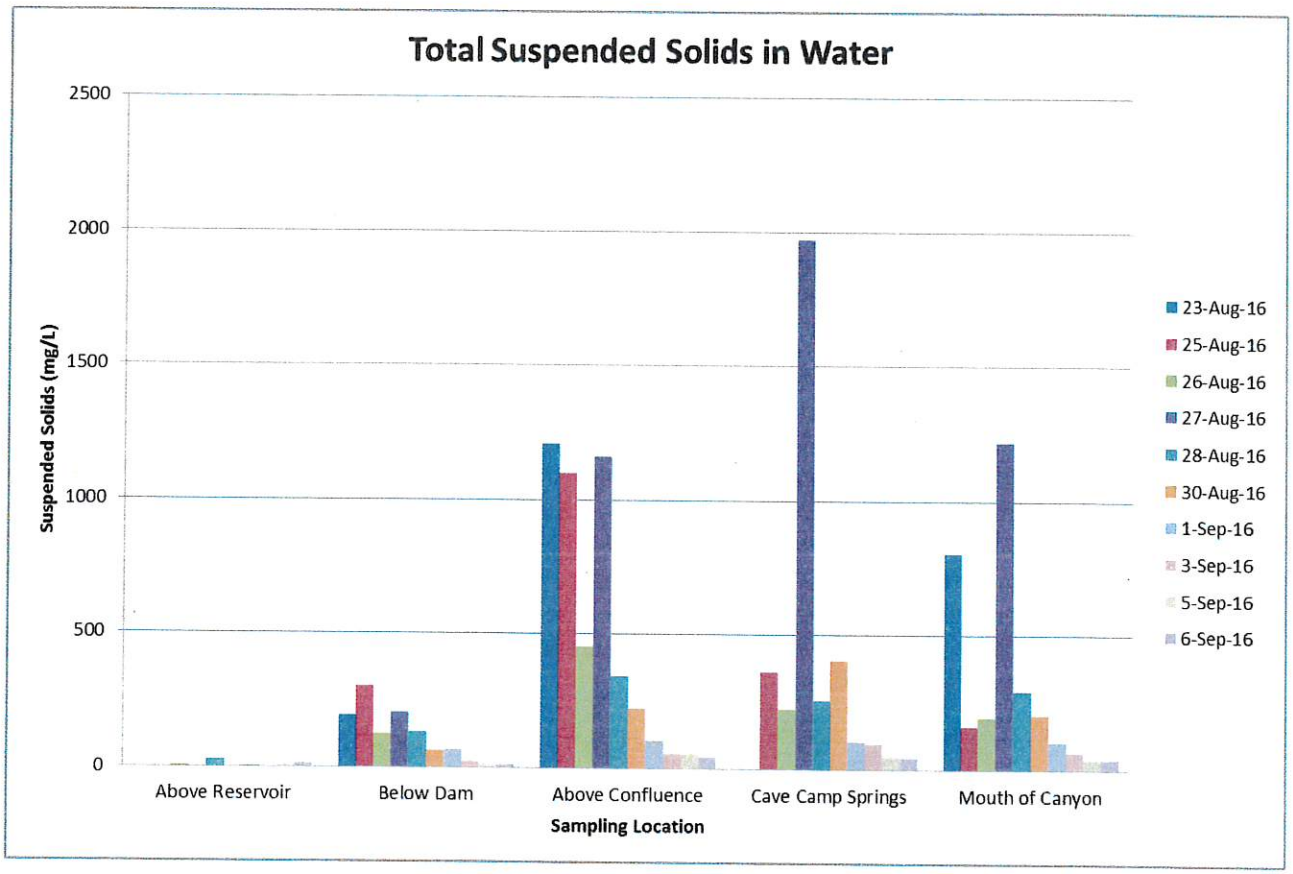
Turbidity is a measurement of water clarity. It is measured in nephelometric turbidity units (NTUs) and captures the amount of light scattered by the solids suspended in the water. In general, the higher the NTU value the more solids there are in the water, although this is dependent on several factors including particle shape and size. The turbidity of the water measured in the samples taken over the past week has roughly correlated with the amount of solids suspended in the water. The North Fork of the American Fork River is extremely clear above the dam and is noticeably more turbid below the dam, confirming a large amount of sediment has been washed down from the dam rehabilitation project.

The turbidity of the water in the river has been slowly but steadily improving since the incident started, with the lowest turbidity values seen in the latest samples taken over Labor Day weekend. The graph below shows the dramatic reduction in turbidity, especially after the North Fork of the American Fork river was diverted past the sediment in the reservoir. These values have been confirmed by data collected by water quality sondes installed above and below the reservoir.



Total Suspended Solids (TSS) is a measurement of solid material suspended (not dissolved) in the water. The levels of suspended solids in the water have steadily decreased since the incident began, reaching their lowest levels in the latest samples which were collected on September 6th. The graph below illustrates the decline.

Water Turibidty and Suspended Sediment



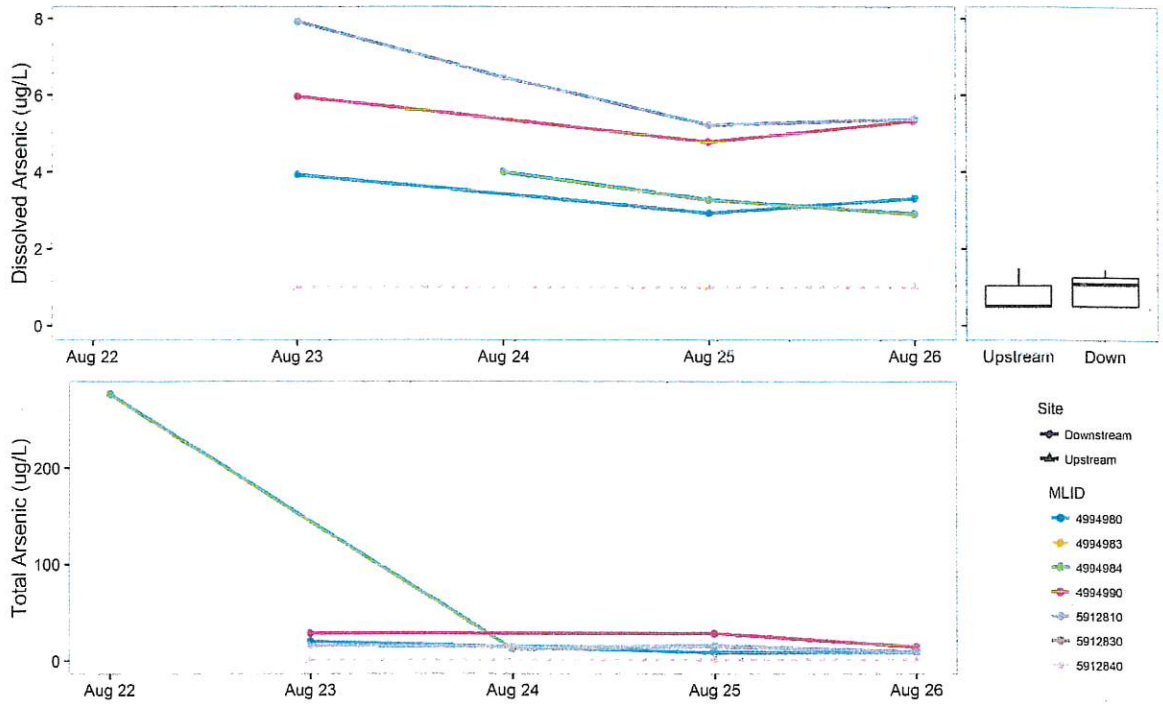
Intially these results violated Utah Water Quality Standards. The TSS results violated Utah's Narrative Standard, which states that it is a violation to "...discharge or place any waste or other substance in such a way as will be or may become offensive...or cause conditions which ...produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life" (R317-2-7.2). The fish kill that occurred as a result of the sediment release further supports the violation of Utah's Narrative Water Quality Standards.

The intital Turbidity results violated a numeric Water Quality Standard which prohibits any discharge that produces an increase in turbidity greater than 10 NTUs above the background level. The latest data confirm the water in the American Fork River has returned to levels which comply with the numeric standard.

Changes in Water Column Metals Over Time

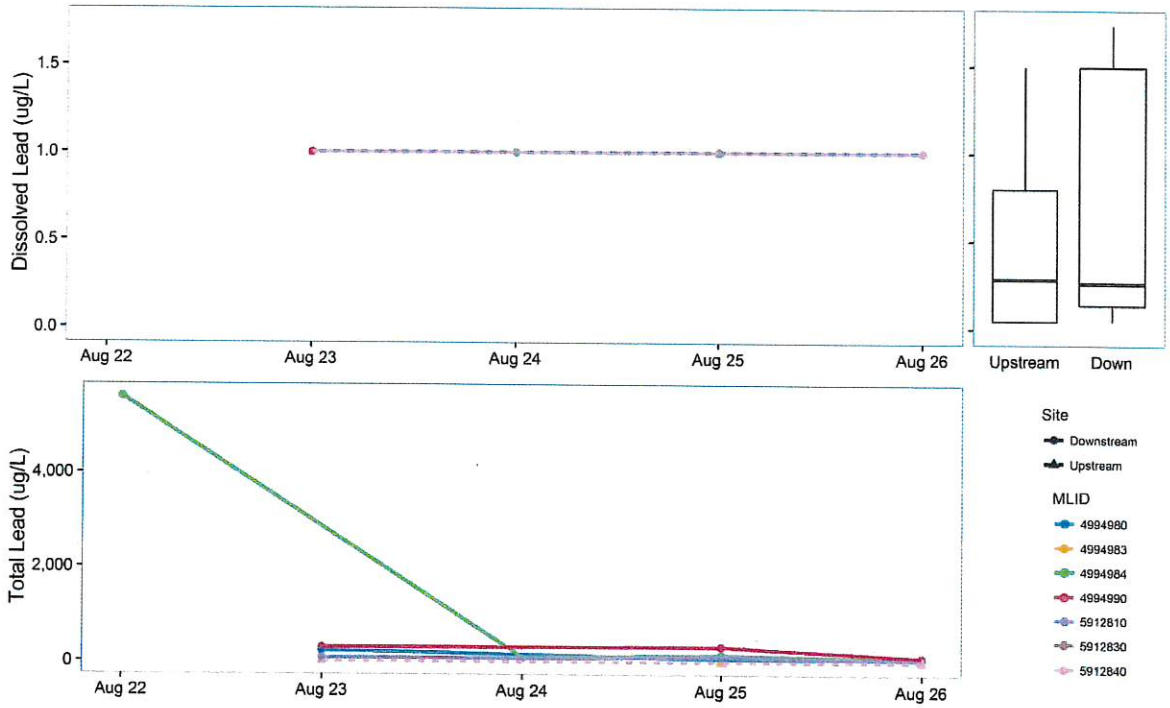
As described above, metal concentrations in up- and downstream waters did not exceed any numeric criteria or human health screening values. As follow up monitoring continues we have observed temporal patterns in Total (unfiltered) and Dissolved (filtered) fractions of several metals. The figures presented below provide an integrated look at how both Total and Dissolved fractions vary since monitoring began. When available, a plot showing the range of historical data (Dissolved fraction only) for upstream and downstream sites is included. Key trace metals presented here include Lead, Arsenic, Cadmium, Copper, and Zinc, which were identified as exceeding aquatic life screening criteria in sediments.

The following figures are comprised of three separate graphs. The upper left graph shows Dissolved concentrations and the lower left graph shows Total metal concentrations in water. Circles represent color-coded monitoring locations below the Tibble Fork Reservoir, while triangles represent color-coded monitoring locations above the reservoir. Monitoring Location codes are identified in the legend (lower right portion of figure), Site Names and coordinates are available in Table 1, above. The x-axis shows the date that samples were collected, starting with August, 22, 2016 (when available), a few days after the sediment release began. Lastly, the graph in the upper right portion of the figure shows two boxplots for any available data from upstream and downstream monitoring locations (see Table 1 and the legend of the following figure); these data provide a sense of historic ambient metals concentrations. Please note that the units of concentration are all as µg/L, the y-axis values differ between the Total and Dissolved fraction graphs for each metal.

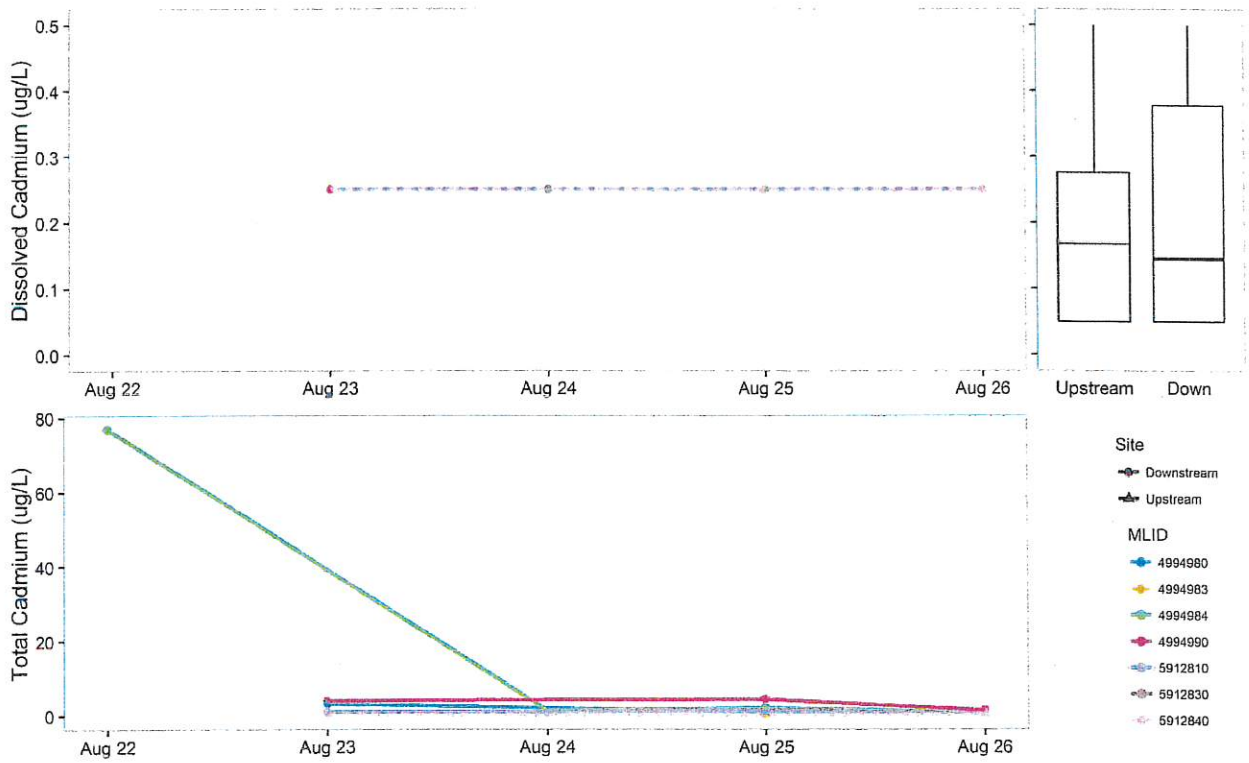


Arsenic concentrations in the Total water fraction were elevated during the main portion of the sediment release, as exemplified by Total Arsenic greater than 250 µg/L at site 4994984 (Cave Camp Spring). Dissolved fraction Arsenic concentrations were elevated in downstream compared to upstream sampling locations, although the downstream values appear to be attenuating over time.

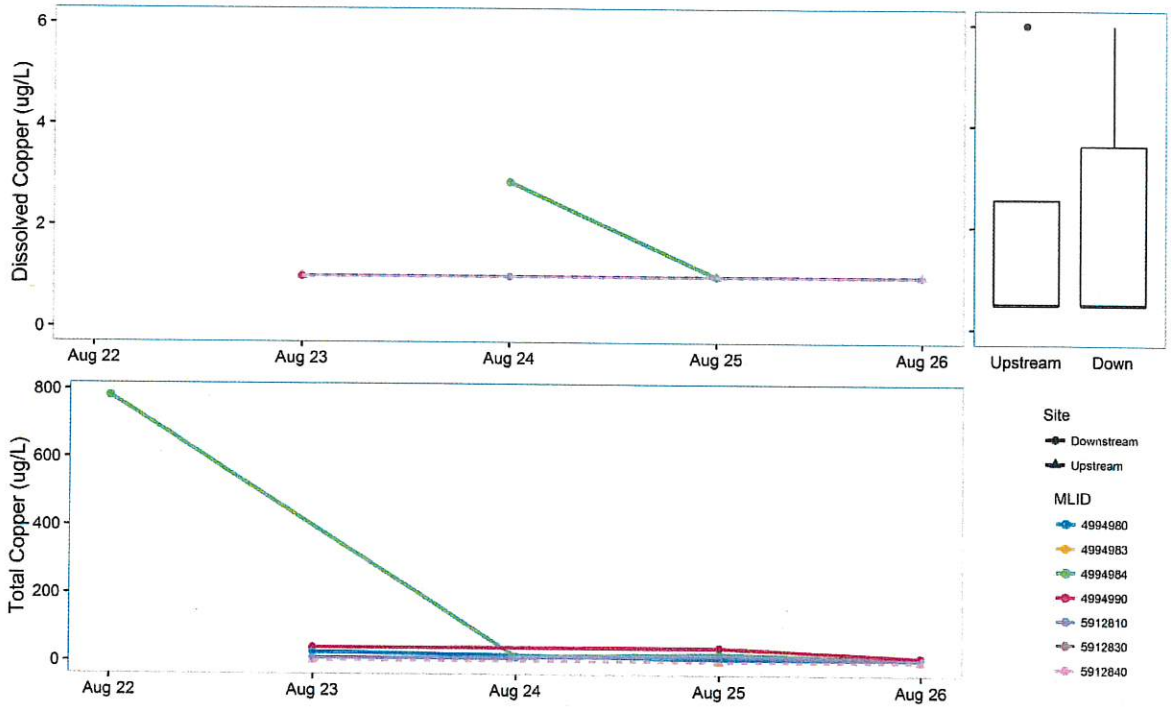
Water Turibidty and Suspended Sediment



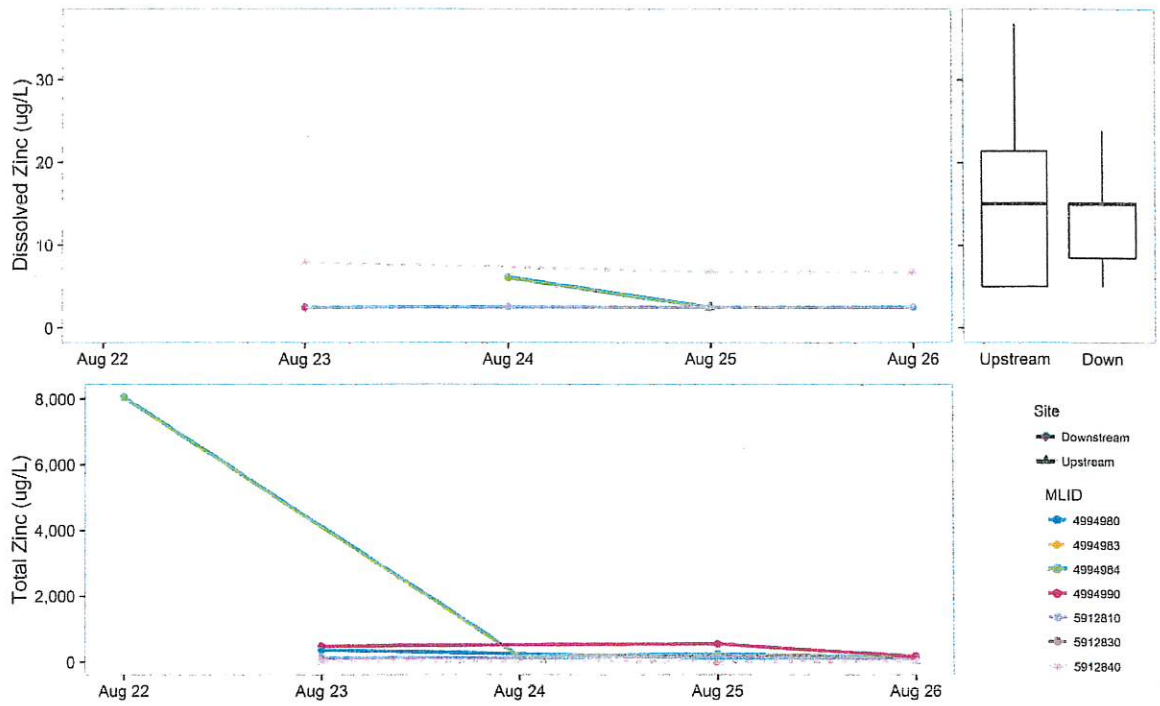
Lead concentrations in the Total water fraction were also elevated during the main portion of the sediment release, with values exceeding 5,000 µg/L on August 22. In contrast, dissolved concentrations remained below the detection limit. While it is a bit difficult to see in this figure, Total Lead concentrations at downstream sites remain elevated (> 60 µg/L) compared to upstream sites and a pre-release sample (concentrations < 1.0 µg/L).



Cadmium concentrations in the Total water fraction were elevated during the main portion of the sediment release, with values exceeding 75 µg/L on August 22. Dissolved Cadmium concentrations and upstream Total Cadmium concentrations remained below detection limits. Downstream Total Cadium concentrations appear to be on the order of 1.4 to 4.0 µg/L, above the baseline upstream concentrations.



Simliar to the previous figures, Total Copper concentrations were elevated during the main portion of the sediment release, with values exceeding 750 µg/L on August 22. Nearly all Dissolved Copper concentrations were below detection limits, however one sample (site: 4994984 on 8/24) was observed at 2.86 µg/L (reporting limit is 2 µg/L). There is some evidence that Total Copper concentrations are attenuating below the Reservoir after release, though they remain elevated (~ 17 µg/L) compared to upstream baseline values (below detection limits).



Lastly, Total Zinc concentrations were severely elevated during the main portion of the sediment release, exceeding 8,000 µg/L on August 22. Interestingly, while most Dissolved fraction Zinc concentrations were below detection limits, one Upstream site (5192840, N. Fk. American Fk River above Tibble Fk Reservoir) had persistently higher concentrations (7-10 µg/L) than all other sites; *the elevated concentrations at this sampling site may be indicative of continuing low-level mining-related discharge in the upper portions of the watershed*. Total Zinc concentrations at downstream sites appear to be attenuating, from ~ 220 µg/L (8/23 – 8/24) to ~ 150 µg/L (8/25 – 8/26).

In summary, Dissolved metal concentrations above and below Tibble Fork Reservoir are below water quality standards and human health screening values. Most Dissolved metal concentrations remain below detection limits. There is evidence that the sediment release lead to a pulse of Total metals in the water column, and that while these concentrations appear to be attenuating over time they remain above background levels.

American Fork Canyon Preliminary Assessment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 8 OCTOBER 2016

Introduction

The U.S. Environmental Protection Agency in partnership with the Utah Department of Environmental Quality (UDEQ) is initiating a Preliminary Assessment (PA) of historic mining sites in American Fork Canyon in the Wasatch Mountain Range in Utah County, Utah.

What is a Preliminary Assessment?

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, to respond to the threats posed by uncontrolled releases of hazardous substances into the environment. The EPA uses a structured site assessment process to evaluate these potential threats and prioritize them for the purpose of taking remedial action. The first step in this process is the PA.

The purpose of the PA is to differentiate sites that pose little or no potential threat to human health and the environment from sites that need further investigation and possible cleanup under CERCLA. The PA also supports emergency response and removal activities, fulfills public information needs, and generally furnishes appropriate information about the site early in the site assessment process.

The scope of the PA is defined in Section 420 of the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), commonly known as the NCP. As the first stage of investigation conducted for every site, the PA is a relatively quick, low-cost compilation of existing information about the site and its surrounding area, with an emphasis on obtaining comprehensive information on targets -- that is, people and resources that might be threatened by a release from the site. A PA generally involves a reconnaissance of the site and its environs. Sampling is typically not conducted during a PA.

Why is the EPA conducting this Preliminary Assessment?

Sites come to the attention of EPA through a variety of methods, including reviewing records, reports and letters provided by states, local governments and concerned citizens. This PA is being conducted in response to multiple requests from a concerned citizen representing Protect and Preserve American Fork Canyon (PPAFC). In these requests, PPAFC has expressed concerns about the impacts to public lands and waters from draining mine tunnels, potential mine pool blowouts and human exposure to surface waste.

When will this Preliminary Assessment be complete?

Expected completion is by the fall of 2017.

What happens after the PA is complete?

In consultation with the UDEQ, information gathered during the PA will be used to decide whether additional CERCLA activities are warranted. Some possible outcomes include:

- Referral to the EPA's Removal program to evaluate more urgent, smaller scale, threats.
- Additional investigation under the site assessment process to evaluate less urgent, larger scale, threats. This investigation is called the Site Inspection.
- No Further Remedial Action Planned (NFRAP) under CERCLA if the threat is found to be relatively low. File information for NFRAP sites is provided to the state, or other regulatory authorities, which may also take action on their own.

For more information, please contact the following EPA representatives:

Ryan Dunham, EPA Site Assessment Manager, 303-312-6627 / dunham.ryan@epa.gov

Jennifer Chergo, EPA Public Affairs Specialist, 303-312-6601 / chergo.jennifer@epa.gov