Summary of 2016 Animas River Water Quality Monitoring at Rotary Park in Durango, CO

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Monitoring Program Overview

Mountain Studies Institute (MSI), an independent research and education center based in the San Juan Mountains, monitored water quality of the Animas River before, during, and after the 2015 Gold King Mine release. MSI continued to monitor the Animas River at Rotary Park in 2016, collecting water quality samples during spring runoff, base flows, and storm events from February through November.

The 2016 monitoring program was part of a partnership between MSI and the City of Durango to communicate Animas River water quality information to the public. Following the 2015 Gold King Mine release, there was increased concern in local communities about the water quality of the Animas River and whether metal concentrations in the river pose any threat to human health, agriculture, or aquatic life.

MSI collected grab samples from the Animas River at Rotary Park at weekly intervals during peak river recreation season, and every other week in February, March, August, September, October, and November (Figure 1). Samples were analyzed by Green Analytical laboratory in Durango, CO, for total and dissolved concentrations of aluminum, arsenic, copper, iron, manganese, lead, selenium, and zinc.

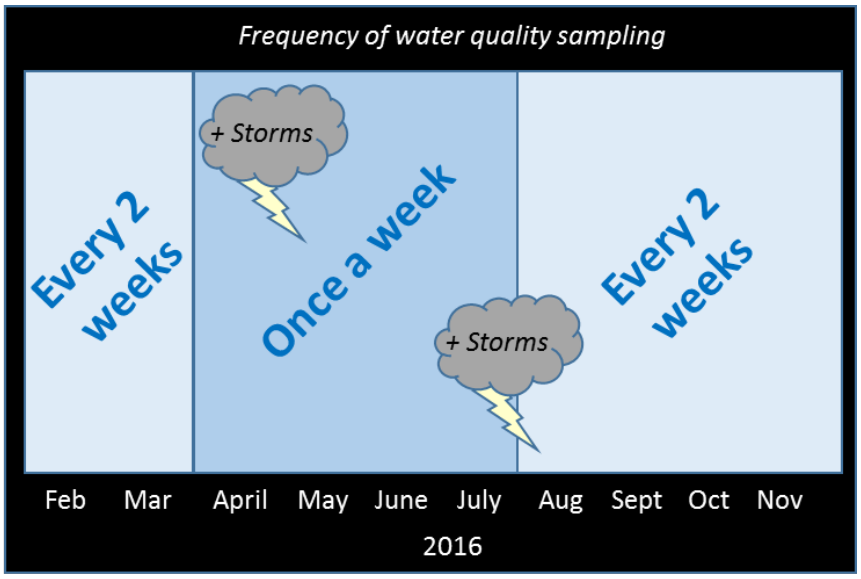


Figure 1: Water quality sampling frequency

MSI's analysis of the 2016 Animas River water quality data centered on four questions:

- How did metal concentrations in 2016 compare to water quality benchmarks?
- Was Animas River water quality in 2016 any different than previous years?
- Do metal concentrations in the Animas River increase during storm events?
- Do metal concentrations in the Animas River correlate with other water quality parameters such as flow, pH, conductivity, or turbidity?

Water Quality Benchmarks

The Colorado Department of Public Health and the Environment (CDPHE) and the Environmental Protection Agency (EPA) have developed water quality standards and benchmarks that can be used to evaluate whether water quality is sufficient to support uses such as recreation, agriculture, domestic water supply, and aquatic life (CDPHE 2017; EPA 2015). Graphs of each metal in relation to water quality benchmarks can be found in Appendix A at www.mountainstudies.org/animasriver.

Recreation

- All metals analyzed in 2016 were below EPA's recreational screening levels, which are protective of users who accidently swallow river water (swimmers, rafters, tubers) or users who intentionally ingest river water (backpackers, overnight river users).

Agriculture

- All metals analyzed in 2016 were at safe levels for agricultural uses such as irrigation and livestock watering (based on CDPHE water quality standards, CDPHE 2017).

Domestic Water Supply

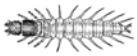
- Most metals analyzed in 2016 were at safe levels for domestic water supply use (based on CDPHE water quality standards, CDPHE 2017).
    - On at least two occasions in 2016, concentrations of lead surpassed CDPHE water quality standards set to protect the Animas River for use as a domestic drinking water source. However, City of Durango water is thoroughly treated and meets all drinking water quality standards prior to public consumption.
    - Levels of manganese surpassed CDPHE water supply standards, but manganese at this level is not of concern for human health. The concern is associated with aesthetic effects such as staining of appliances.

Aquatic Life

- Metals thought to be most harmful to aquatic life (copper, zinc, and selenium) were found to be at levels considered safe (based on CDPHE water quality standards, CDPHE 2017). However, MSI did detect high levels of iron and aluminum.
    - Iron surpassed the CDPHE chronic water quality standard. Chronic water quality standards are set by CDPHE to be protective of aquatic life from persistent, long-term exposure to a contaminant.

- Aluminum was close to surpassing the CDPHE chronic water quality standard for aquatic life (aluminum surpassed the chronic water quality standard based on average hardness, but did not surpass the chronic water quality standard based on paired metal-hardness values).

Table 1: Water quality benchmarks.

					
Metal	CDPHE Domestic Water Supply Standard	CDPHE Agriculture Chronic	CDPHE Aquatic Life Acute Standard	CDPHE Aquatic Life Chronic Standard	EPA Recreational Screening Level
Aluminum	-	-	n	n	n
Arsenic	n	n	n	n	n
Copper	n	n	n	n	n
Iron	n	-	-	Y	n
Lead	Y*	n	n	n	n
Manganese	Y**	n	n	n	n
Selenium	n	n	n	n	n
Zinc	n	n	n	n	n
n = metal did not surpass water quality benchmark *Y = metal surpassed water quality benchmark* *- = no water quality benchmark available*					

*This standard is based on pre-treated river water. City of Durango water is thoroughly treated and meets all drinking water quality standards prior to public consumption.

** Manganese at this level is not of concern for human health. The concern is associated with aesthetic effects such as staining of appliances.

2016 Water Quality Data in Context of Historical Data

Following the 2015 Gold King Mine release, there was concern that the water quality of the Animas River could be worse, in 2016, than during years prior to the Gold King Mine release. Using historical data from the Colorado River Watch program, MSI compared 2016 Animas River water quality data to data from 2002-2014.

- Statistical analysis indicated that metal concentrations in the Durango stretch of the Animas River were *not* significantly higher in 2016 than in 2002-2014.
- In other words, metal concentrations at Rotary Park in 2016 were consistent with observations from 2002-2014.

Spring Runoff and Storm Events

The Animas River naturally turns various shades of brown during spring runoff as a result of snowmelt and suspended sediment. Changes in river color also occur after storm events when

rain water flows over the adjacent landscape and delivers sediment to the river. MSI assessed whether metal concentrations were higher during changing river conditions (storm events or when spring runoff caused a rapid rise in river level) as compared to during stable conditions.

- Statistical analysis indicated that several metals in 2016 were significantly higher during periods of quickly changing conditions (storm events or rapidly rising river levels).
    - Total aluminum
    - Total arsenic
    - Total iron
    - Total manganese
    - Dissolved manganese
    - Dissolved zinc
- The elevated levels of metals observed in the Durango stretch of the Animas River during storm events were not high enough to pose a threat to human health.

Metals and Other Water Quality Parameters

In 2016, USGS began to provide continuous measurement of pH, turbidity, and conductivity at several gauges on the Animas and San Juan Rivers including the Animas River gauge in Durango, CO. MSI examined the relationship between metal concentrations and these additional water quality parameters.

- In 2016, concentrations of several metals correlated at a statistically significant level with discharge, turbidity, pH, and conductivity (Table 2).

So What?

The 2016 water quality data from Rotary Park was encouraging – we have no indication of any threat to human health from Animas River water in Durango and it does not appear that metal concentrations in 2016 were any higher than previous years (2002-2014). We did detect elevated metal concentrations during storm events when turbidity and discharge rose, and conductivity and pH dropped. However, the elevated levels of metals observed in the Durango stretch of the Animas River during storm events were not high enough to pose a threat to human health.

The data did raise concerns for aquatic life in the Durango stretch of the Animas River. These concerns can only be evaluated by continued monitoring of water quality and aquatic life.

For more information regarding MSI's 2016 water quality monitoring analysis, including technical details, tables, graphs, and statistics, please see Appendix B at www.mountainstudies.org/animasriver.

Table 2: Relationship between metal concentrations and discharge, turbidity, pH, and conductivity.

					Aluminum		Arsenic		Copper		Iron		Lead		Manganese		Zinc	
					T	D	T	D	T	D	T	D	T	D	T	D	T	D
When…	*...discharge…*	*...increased…*	*...the following metals…*	*...increased*	X				X	X	X		X		X		X	
	...turbidity…	*...increased…*		*...increased*	X		X		X	X	X		X		X		X	
	...turbidity…	*...increased…*		*...decreased*												X		X
	...pH…	*...decreased…*		*...increased*	X				X	X	X		X		X		X	
	...conductivity…	*...decreased…*		*...increased*	X				X	X	X		X		X		X	
	...conductivity…	*...decreased…*		*...decreased*												X		

Note: X with blue highlight indicates a metal that correlated with a water quality parameter at a statistically significant level.

References:

Colorado Department of Public Health and Environment (CDPHE). 2017. Regulation No. 31 - The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31), effective 3/1/17. Available: https://www.colorado.gov/pacific/cdphe/water-quality-control-commission-regulations.

EPA. 2015. Memorandum: Screening Levels for Recreational Receptors at the Gold King Mine Site. September 2015.