Mountain Studies Institute
Rotary Park Sample Location Data Explained

This document was prepared by Mountain Studies Institute (MSI) with the help of Animas Watershed Partnership, and was developed to aid in the interpretation of MSI's water quality samples taken from Rotary Park, Durango, CO, and processed by Test America Laboratories, Savannah, GA.

Executive Summary

The following graph series represents the results of MSI's water sampling at Rotary Park in Durango, CO from August 6th, 6:00PM through August 11th, 6:00 PM. These data represent samples taken from the Animas before the arrival of the Gold King plume, the plume passing through MSI's established sampling point, and several days following the plume's passing. Each graph represents a single metal that was tested for during the analysis of each sample. The samples were analysed at an independent laboratory, Test America Laboratories, using methods that test for the presence of 24 heavy metals and non-metals (EPA 200.7, EPA 200.8, and EPA 245.1). Several metals reported in the analysis were not graphed as they were not detected, in the case of Nickel or Beryllium, or not being a health concern, in the case of Calcium, Potassium, and Sodium. Additional data will be added as the results become available.

Deciphering the Data

The metals displayed in the following graphs can pose a risk to human health under certain conditions. Note: for the purposes of interpreting these data we are focusing on the risk to human health and not the risk posed to aquatic life in the Animas River. For each metal, when applicable, several standards have been plotted. These standards include: the Maximum Contaminate Level (MCL), as defined in EPA's National Primary Drinking Water Regulations; the MCL defined by EPA's National Secondary Drinking Water Regulations (NSDWR); and surface water screening levels for recreation exposure, as well as water quality standards as defined by the Colorado Water Quality Control Commission (see next section for more information on how these standards are developed).

An explanation of these standards is as follows: Plotted on each graph is the concentration of the metal over time. Concentration is defined as the percentage of substance within another substance. In the case of these samples, concentration is defined as the percentage of metal per volume of water. Values are recorded in one of two ways depending on the constituent:

- micrograms (0.000001 grams) per liter, **µg/L**
- parts per billion, **ppb**.

To visualise a part per billion (ppb), think of an Olympic swimming pool which holds about 130,000 gallons or 500,000 liters. One ppb is approximately one drop of water (1/2 milliliter) in the pool. Some metals, like iron, normally have higher ppb values, while others normally have very small ppb

values, like mercury. It is normal to see higher concentrations of iron than mercury in natural systems.

Several water quality standards have been plotted with each metal and are referenced in the legend of each graph. In some cases, the concentration of the metal is so far below the standard that the standard will not be visible on a typical graph; the graphs are presented with a logrhythmic scale (1, 10, 100, 1000, etc) in order for the standards and the values to be visible in one visual. See the graphs at the end of the document for examples.

What Are Water Quality Standards and Recreation Screening Levels?

The EPA is responsible for implementing the Clean Water Act across the nation. In Colorado, the EPA has delegated that authority to regulate and protect water quality in our streams and lakes to the state. This authority is administered by Colorado's Department of Public Health & Environment. The governor appoints a Water Quality Control Commission (WQCC), which sets standards to protect water quality appropriate to support four uses: domestic water supplies, recreation, agriculture, and aquatic life. The WQCC holds meetings in each of Colorado's major river basins to adopt water quality standards for each river's specific segments. When setting standards for the physical, biological, inorganic and metal parameters of these waters, the commission considers the geology, context, and uses of each river basin and segment, and balances what is possible to achieve for water quality and what the existing or potential uses for the water are. These standards are intended to allow us to gage what water quality sampling data means; they are the link between the data and the risk to our health. A table listing Colorado's numeric water quality standards for the Animas River can be accessed here. In order to effectively understand the water quality standards, it is important to understand that they are set at three levels: the State of Colorado, each river reach, and in context of the presence of calcium and other minerals, which affects the hardness. Each of these are explained in this section.

Water quality standards are based in the science of risk assessment of the potential for illness. There are two levels to note: *acute*, which is an immediate hazard from one high level exposure, and *chronic* which describes longer term, repeated, low level exposure over months or years. The standards also are reviewed, debated, defended, and assailed by citizens and entities who participate in the public process around the standard's adoption by WQCC.

The reach of the Animas River from Bakers Bridge to the Southern Ute Indian Tribe's northern boundary is known as "Segment 5a." The WQCC has classified this segment as supporting all four uses: Durango residents drink its waters; everyone and their brother swims, flops, splashes, surfs and paddles in it (and sometimes gulps or snorts it); farmers and gardeners water their crops with it; and trout and other fish live in it. Because each of these uses, particularly the use for domestic water supply, depends on high quality, the WQCC applies some of its highest standards to our beloved Segment 5a. These standards are intended to provide the benchmarks that allow us to gage what water quality sampling data means; they are the link between the water sampling data and the risk to our health. A table listing Colorado's numeric water quality standards for the Animas River is in Regulation 34 and can be accessed at (www.colorado.gov/pacific/cdphe/water-quality-control-commission-regulations).

Many standards are set at the same level across Colorado- these are known as Table Value Standards in Regulation 31. In Segment 5a, lead is one such example. The Table Value Standard is 50 micrograms/liter (µg/L) Total Lead to protect the domestic water supply use, 100 µg/L Total Lead to protect the agriculture use, and a hardness dependent level to protect aquatic life. Others, like arsenic, have a specific standard that was set for this reach. Also, some metals behave differently when calcium, dissolved minerals, and other factors of hardness are present- these standards are calculated through a complicated formula and will vary depending on each water sample, such as aluminum.

In addition to Colorado's WQCC water standards, the graphs here reflect the EPA Recreational Screening Levels for long-term, chronic exposure. EPA evaluates the risk to human health for different heavy metals using a risk based approach. For the analysis, it is important to consider how a person would contact the river, for how long at each exposure, and repeated over a length of time such as a month or a year. Therefore, recreation screening levels are not managed in the same way as standards for drinking water because there are many different ways people interact with the river.

For the Gold King spill, the EPA developed a site-specific recreation screening level for the Animas River. As defined by EPA, recreational screening levels are the "…levels of exposure below which recreational exposure is deemed not a risk to long term or chronic health." The levels shown in MSI's graphs reflect published EPA screening levels for surface water consumption by an adult or child who intentionally or accidentally ingests, by mouth, 2 liters of water per day, for four days per week, over a 16 week period. The EPA set the screening level to be safe for people with a high frequency of exposure over the summer river season assuming: the recreator drinks 2 liters of river water every day while swimming or boating 4 times a week and is exposed to the sediments by camping or living along the river bank for a continuous 64 day period. In reality, very few people will experience this level of exposure in any given day, let alone every other day for 16 weeks. Therefore this screening level is considered to be very conservative. In simpler terms, at these levels, you would need to drink 2 liters of Animas water four days a week, for 16 weeks, to possibly experience adverse, non-cancer, effects of those metals over a long period of time, years later.

What Does pH Mean And Why Is It On These Graphs?

There are many factors that go into determining these screening levels and water quality standards in general. One of those factors is the pH of the water, which you will see graphed alongside every metal in each graph. pH is a measure of the acidity (acidic) or alkalinity (basic) of a solution that is measured by determining the concentration of the hydrogen ion activity in a solution. A neutral pH equals 7. It is widely recognized that a pH range of 6.0-9.0 can sustain life of freshwater fish, invertebrates and most macroinvertebrates. pH values that exceed 9.0 or drop below 6.0, over time, pose environmental impacts and threats to fish and aquatic life. For example, trout tolerate a pH range of 4.1 – 9.5, and most fish can tolerate a range of 5.0 - 9.0. Below a pH of 3.8 and above a pH of 10.0 fish eggs may be unable to hatch or the young may be deformed if produced. Insect larvae and algae also operate under similar environmental conditions. Furthermore, pH is synergistically linked with the other substances in the solution, in particular metals. For example, a measure of iron in solution at a pH of 4.8 would not present a toxic effect to aquatic life, but at a pH of 5.5, the same measure of iron may cause detrimental effects to aquatic life.

The pH of water determines the solubility (amount that can be dissolved in water) and the biological availability (amount that can be absorbed by aquatic life) of heavy metals and nutrients. In the case of heavy metals, the degree to which they are soluble directly influences their toxicity. The presence of iron will lower the pH enabling other heavy metals to go into solution. As the pH returns to neutral, most metals will drop out of solution. In other words, the combination of two or more substances in solution can produce effects that are greater than that of each substance's existence on its own. This synergistic relationship is the reason that pH is plotted on the graph alongside each metal—to tell the whole story.

OK, But What Does This Mean For Me?

The news from these data and other data taken along the Animas River and the San Juan River is that the major human health concerns generated from the plume were very short lived. We see a spike in metals as the plume passed, but concentrations for all metals returned to either non-detectable or pre-plume levels within a weeks time. pH dipped at our sampling location as the plume passed in the first 24 hours, but has since then stabilized to normal levels previously seen in the Animas River. There is a slight increase in metals from the sample taken at noon on August 9th. While none of the metals exceeded water quality levels, except manganese, which is naturally high in the Animas, we can hypothesise that this increase was due to increased flow caused by precipitation on the 7th. This slight uptick speaks to the lingering concerns post plume from the deposited sediments. We would expect to see slight increases in metal detections as we experience precipitation events this fall and with spring runoff next year.

MSI continues to sample water quality and pH daily at Rotary Park. In addition, we may increase sampling frequency on a special event basis where special event is meant to capture any changes in water quality related to precipitation or human activities. Special event samples include runoff events that may mobilize sediment left behind from the original spill or be associated with new releases. Special events are identified as disturbances around spill sites and high runoff.

Based on precipitation amounts that are typical of this region per event, we would not expect precipitation to drive an increase in metal detections to be as acute as the plume itself.

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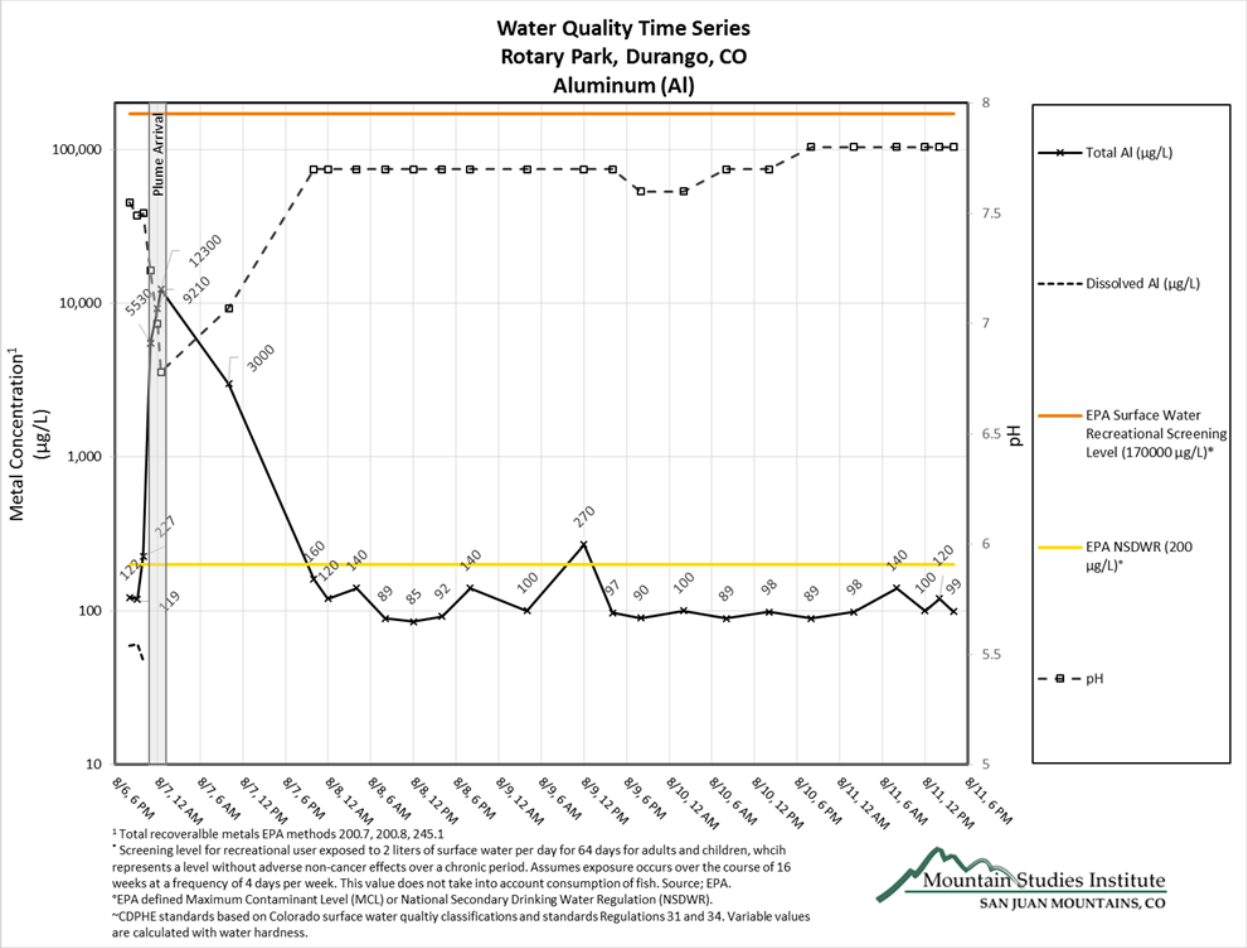
MSI is an independent, not for profit scientific research organization. We are committed to long term monitoring of the Animas River. We aim to use our data to better inform the public and the scientific, regulatory, and local communities of potential lasting effects from the Gold King spill and the effectiveness of recovery actions.



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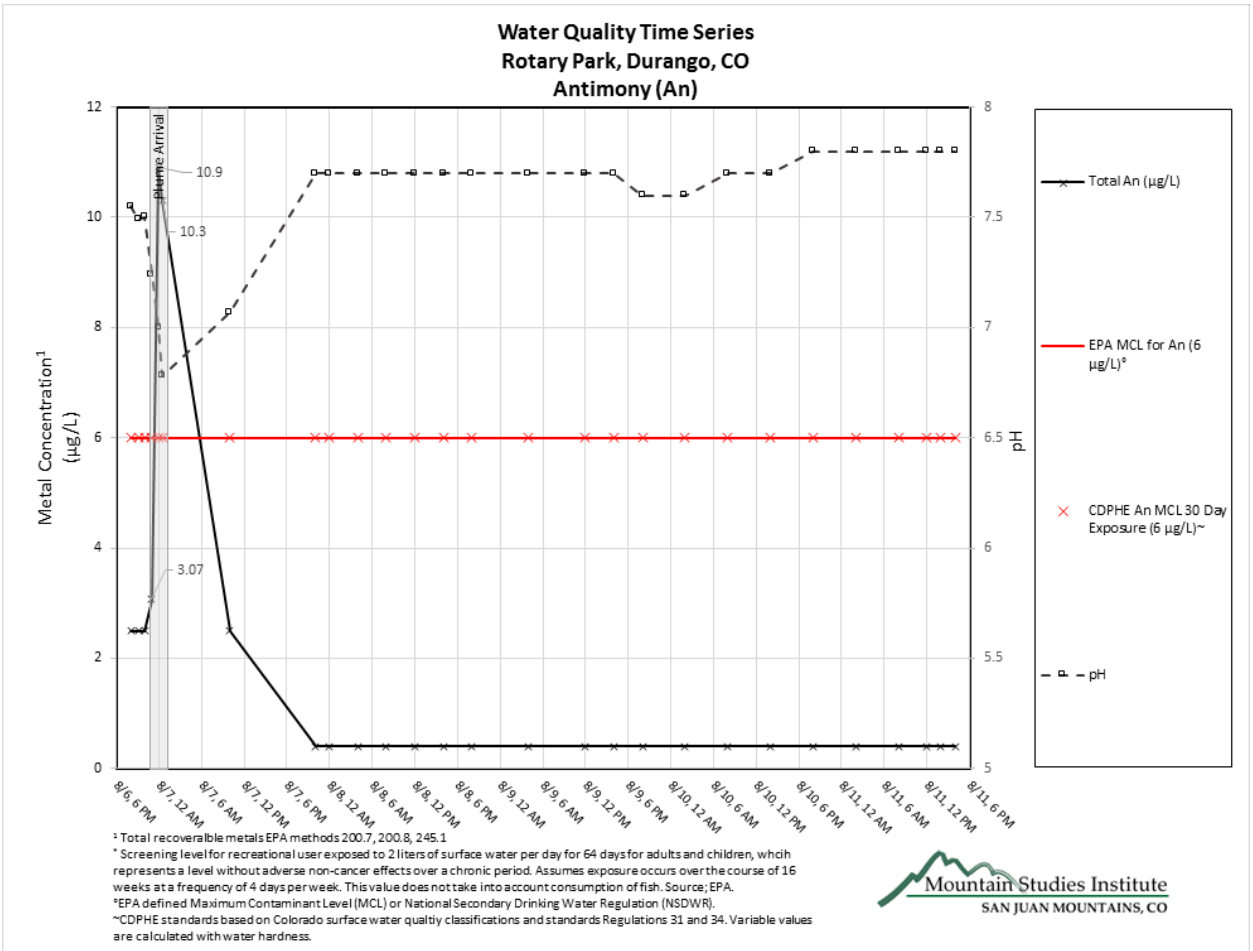

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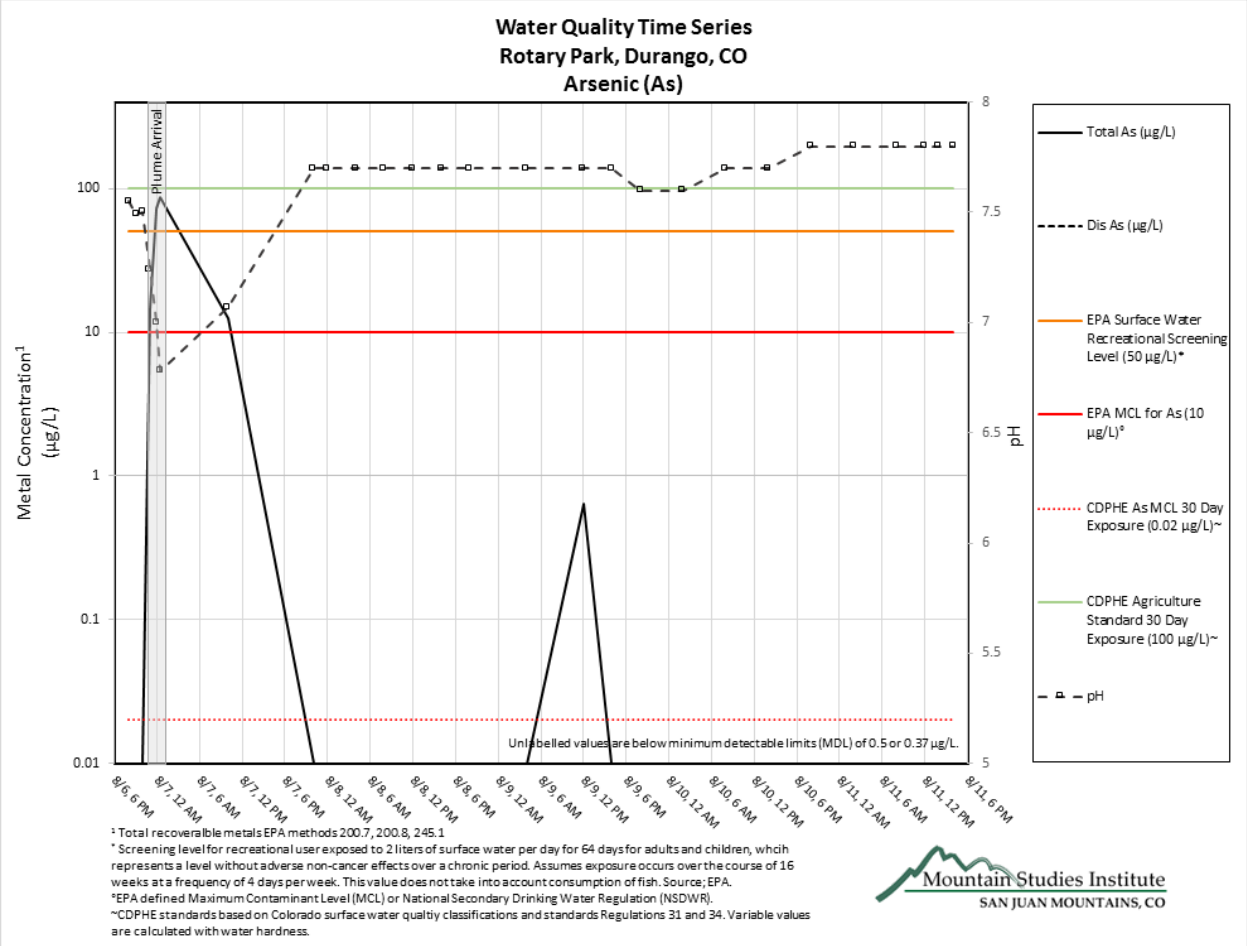

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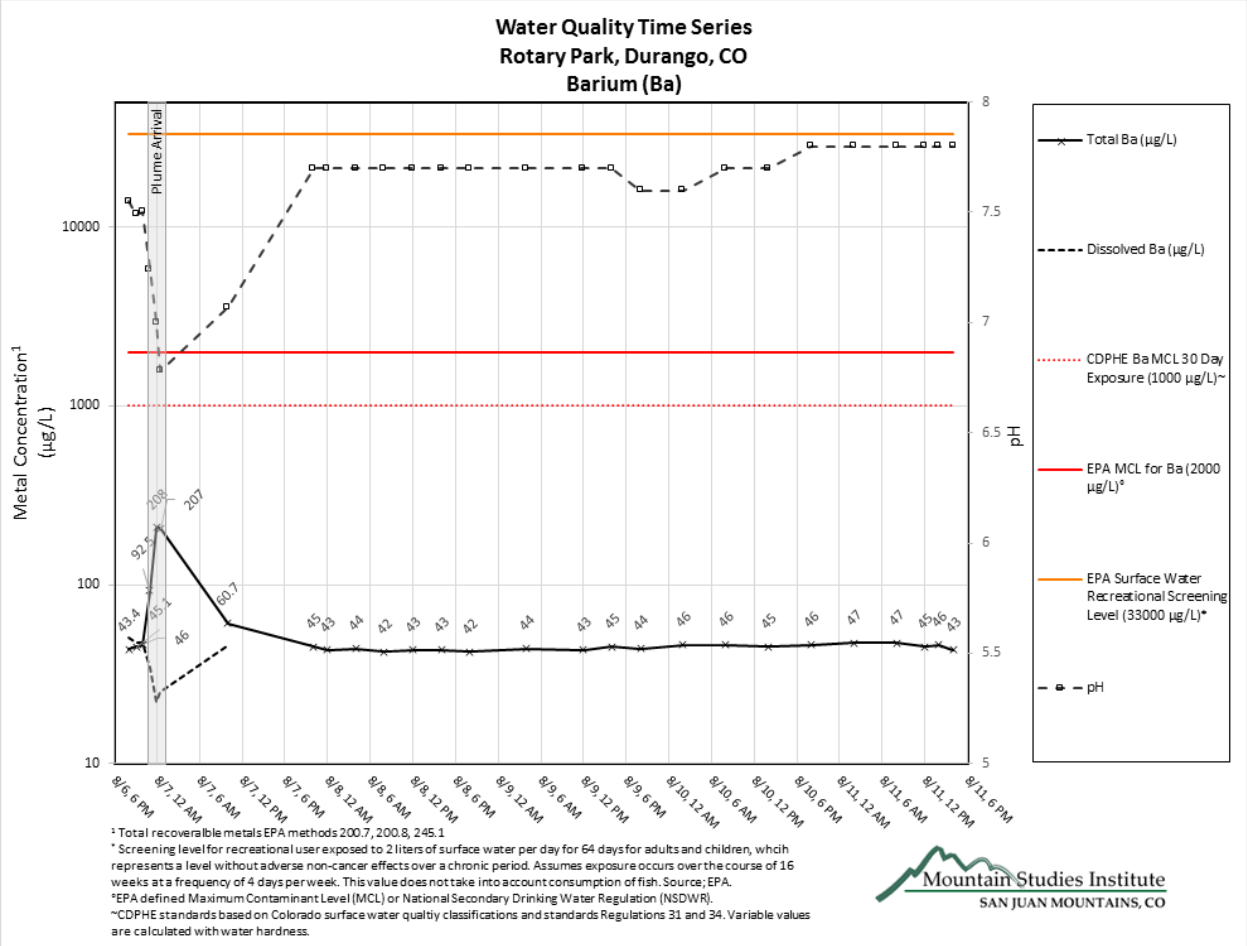

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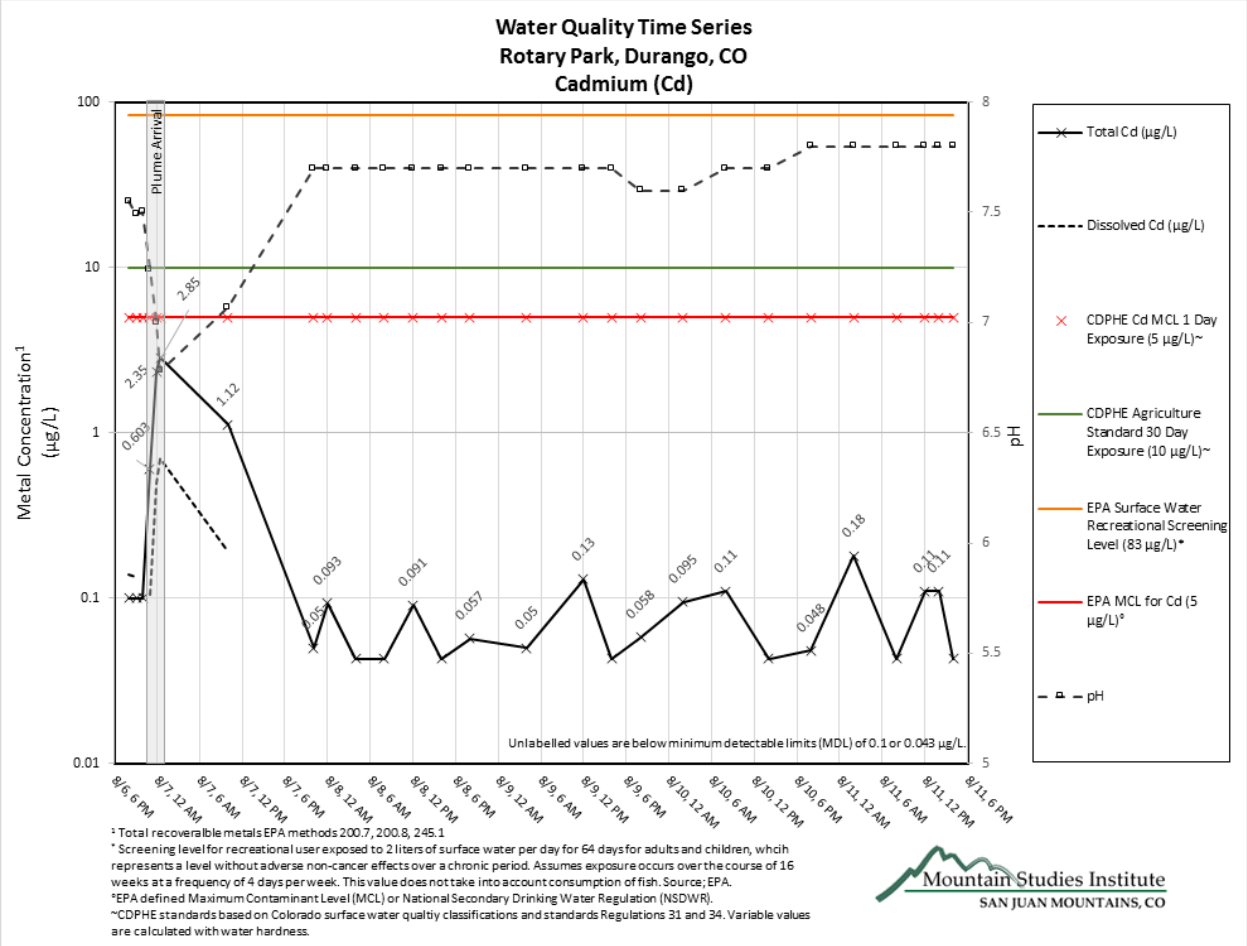

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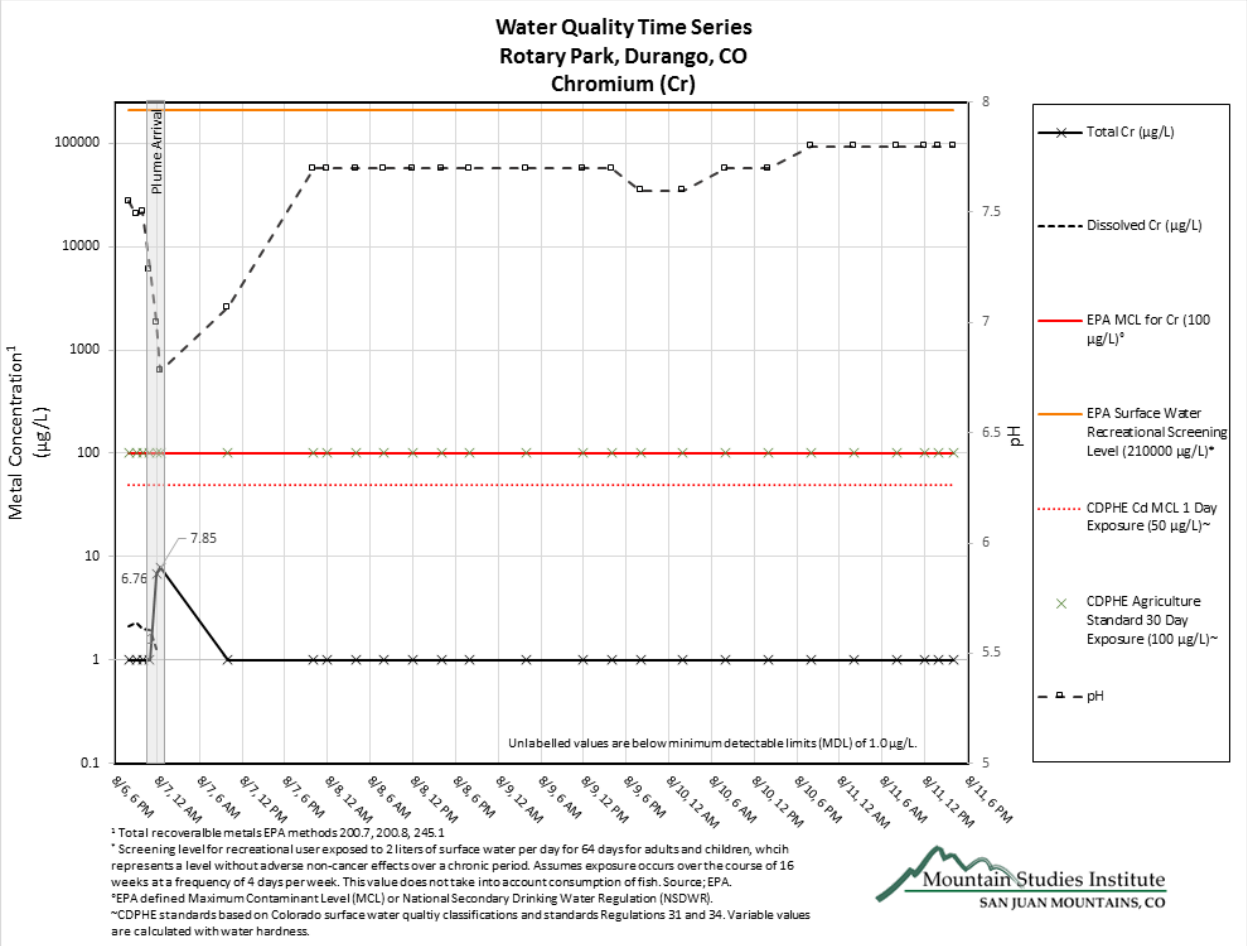

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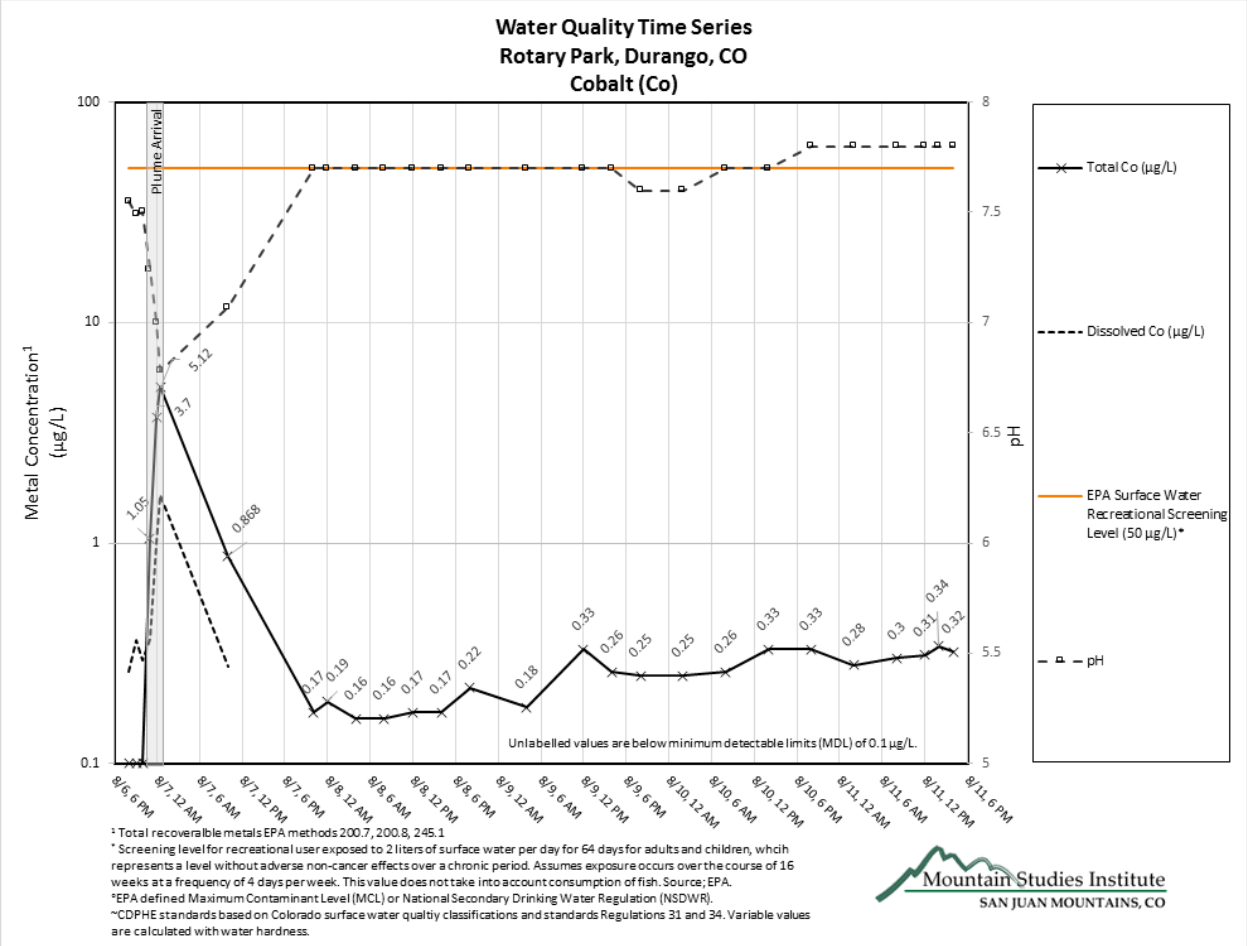

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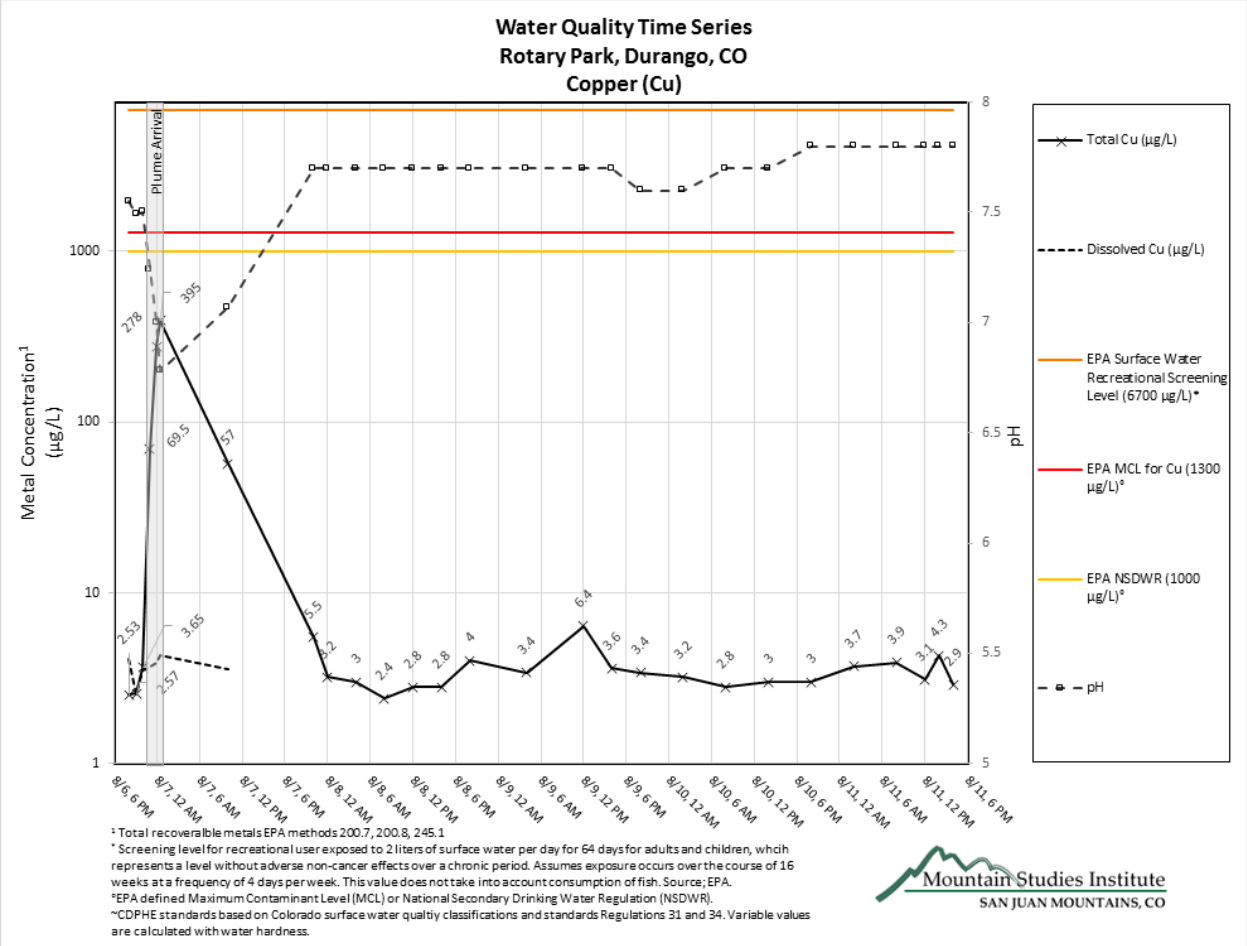

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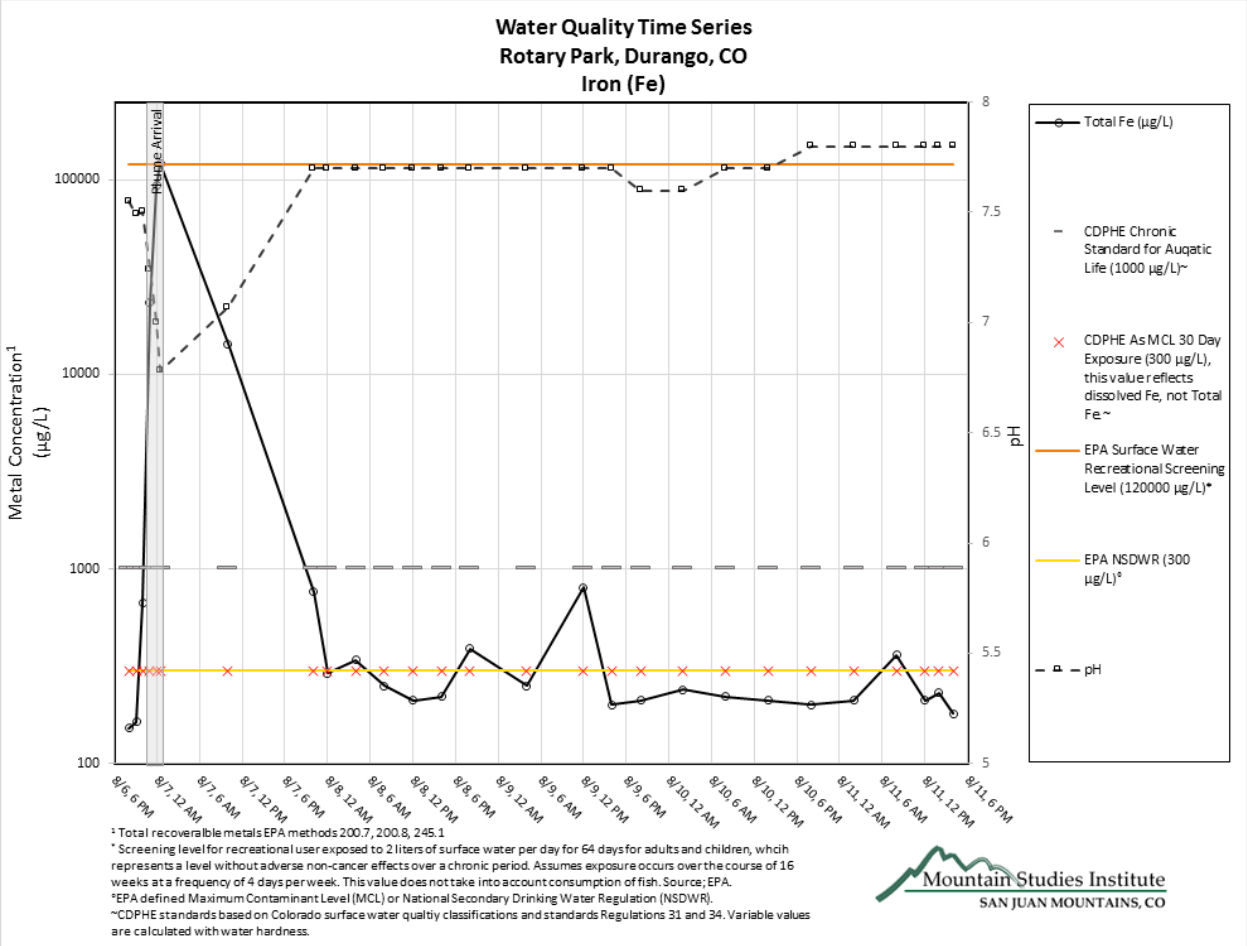

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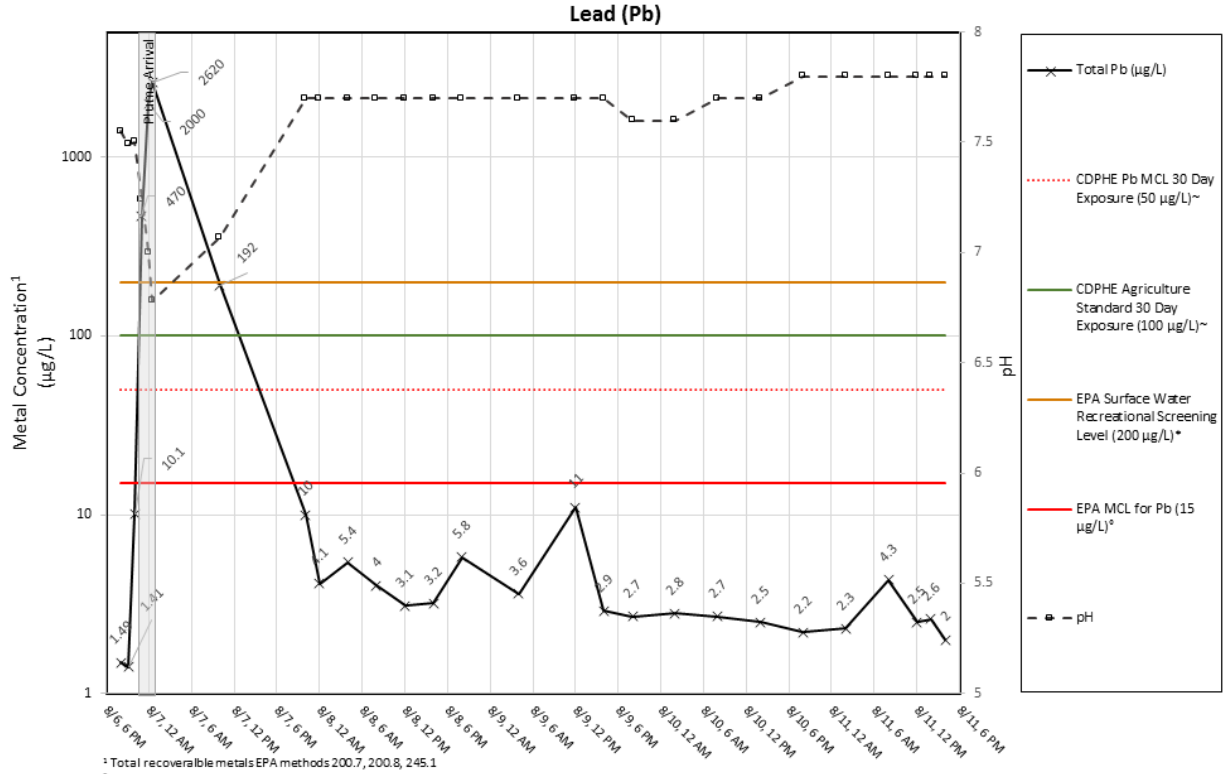
Water Quality Time Series
Rotary Park, Durango, CO
Lead (Pb)



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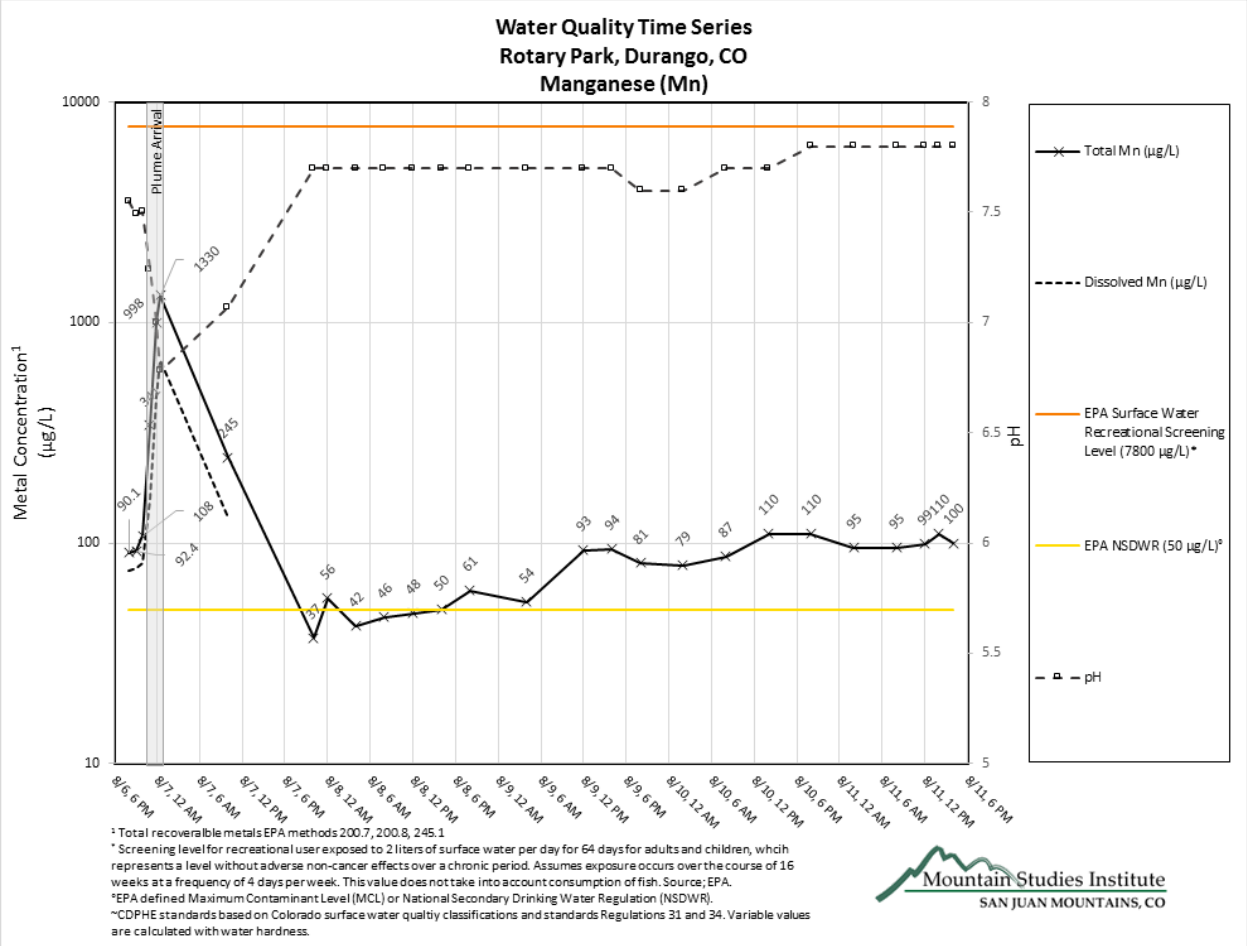

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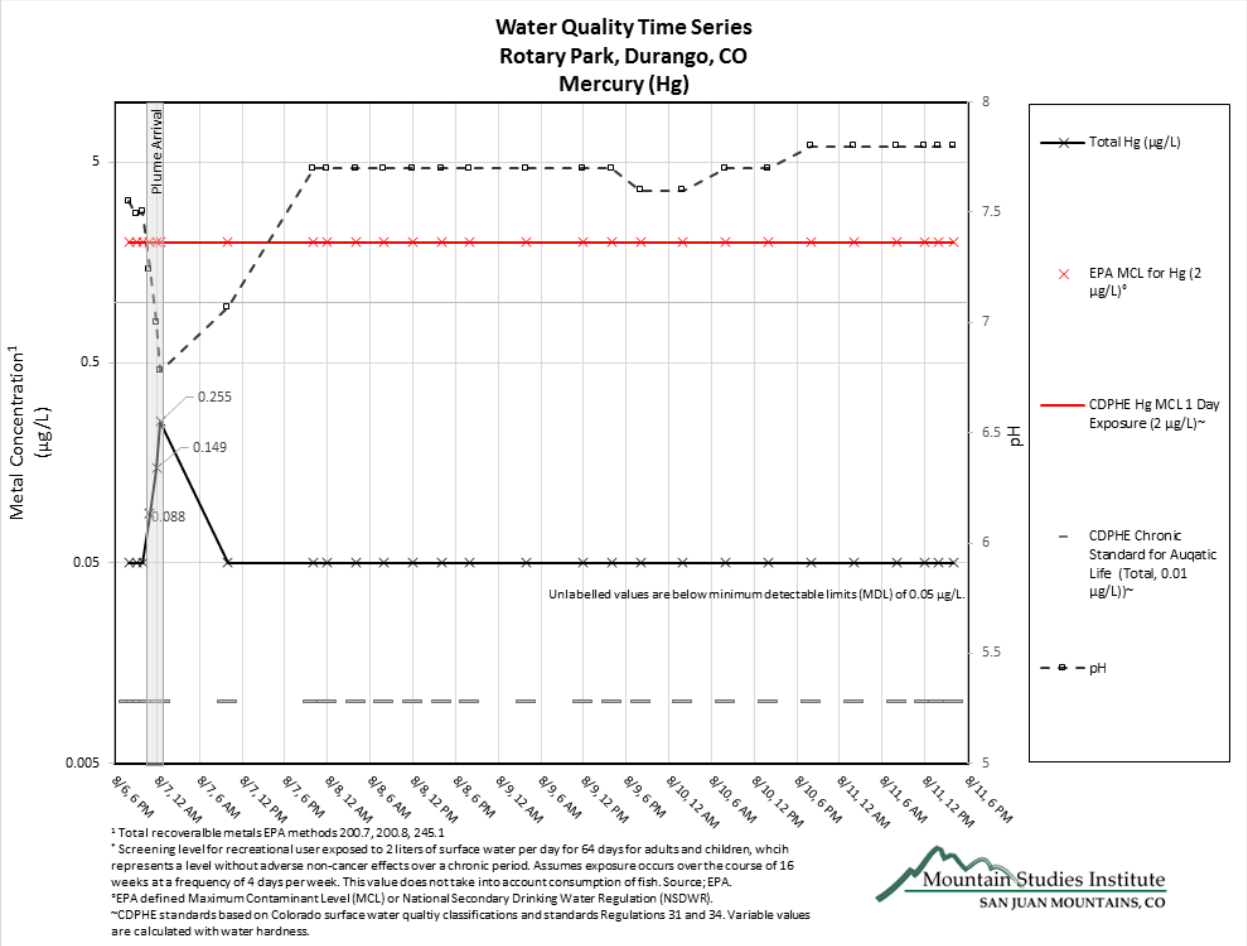

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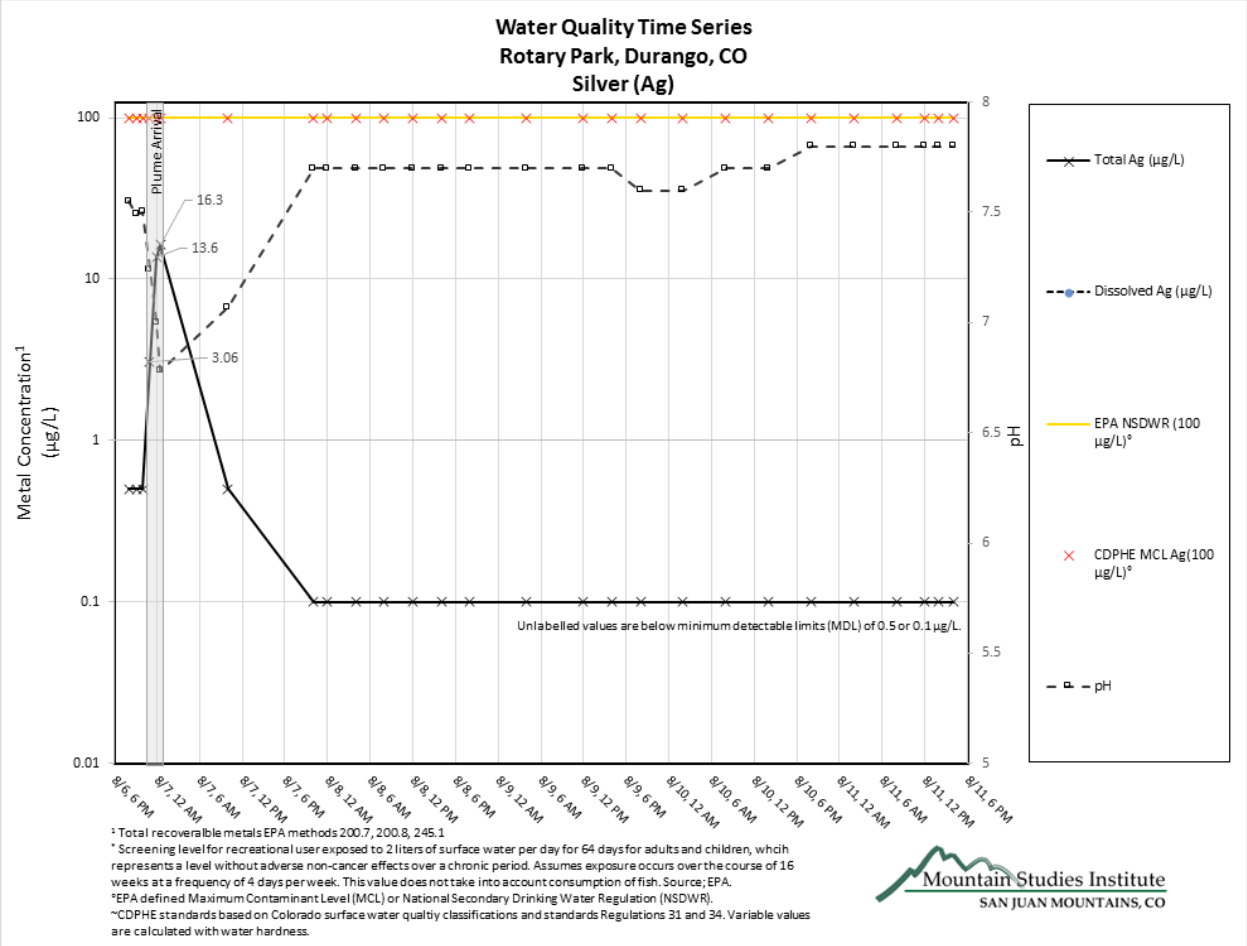

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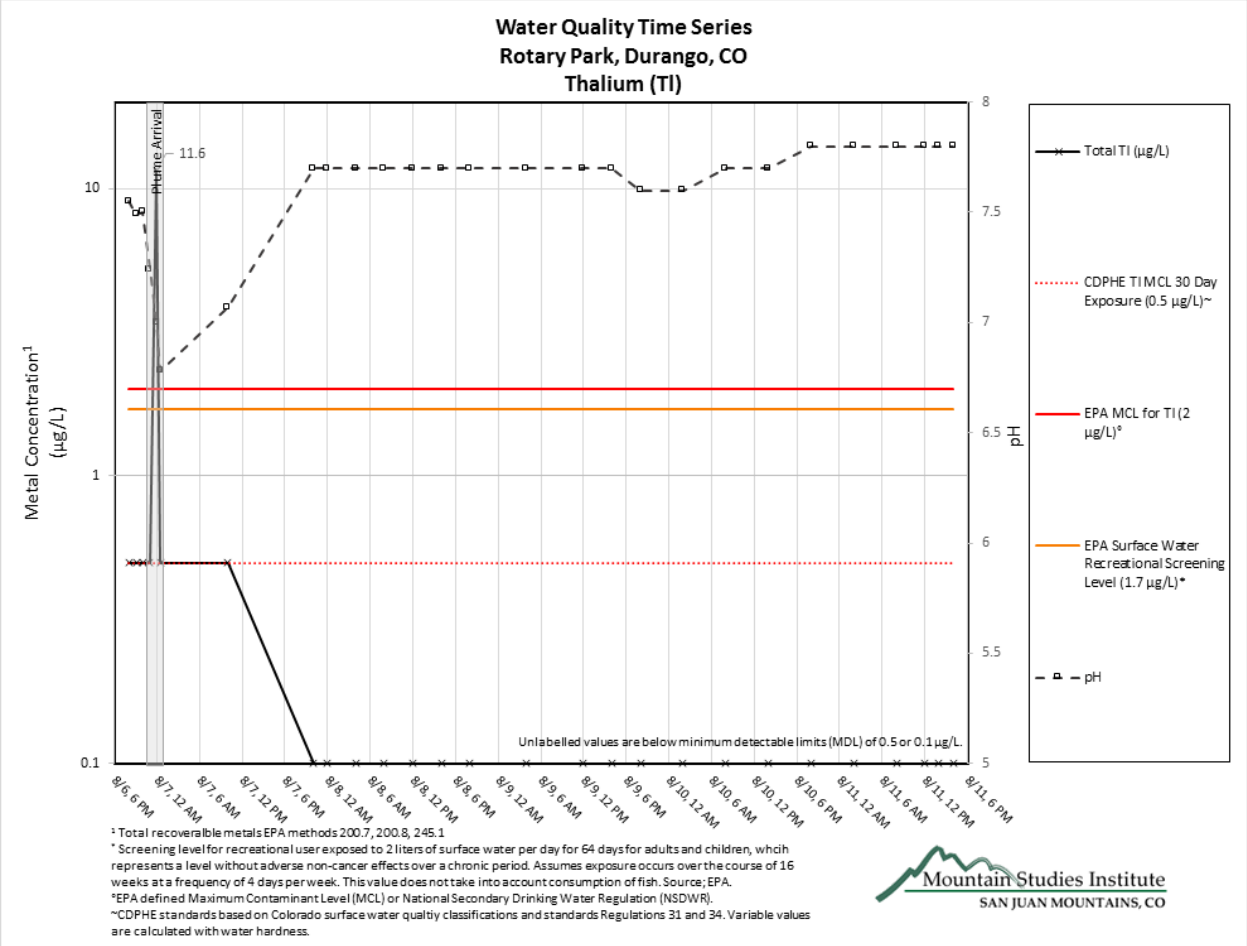

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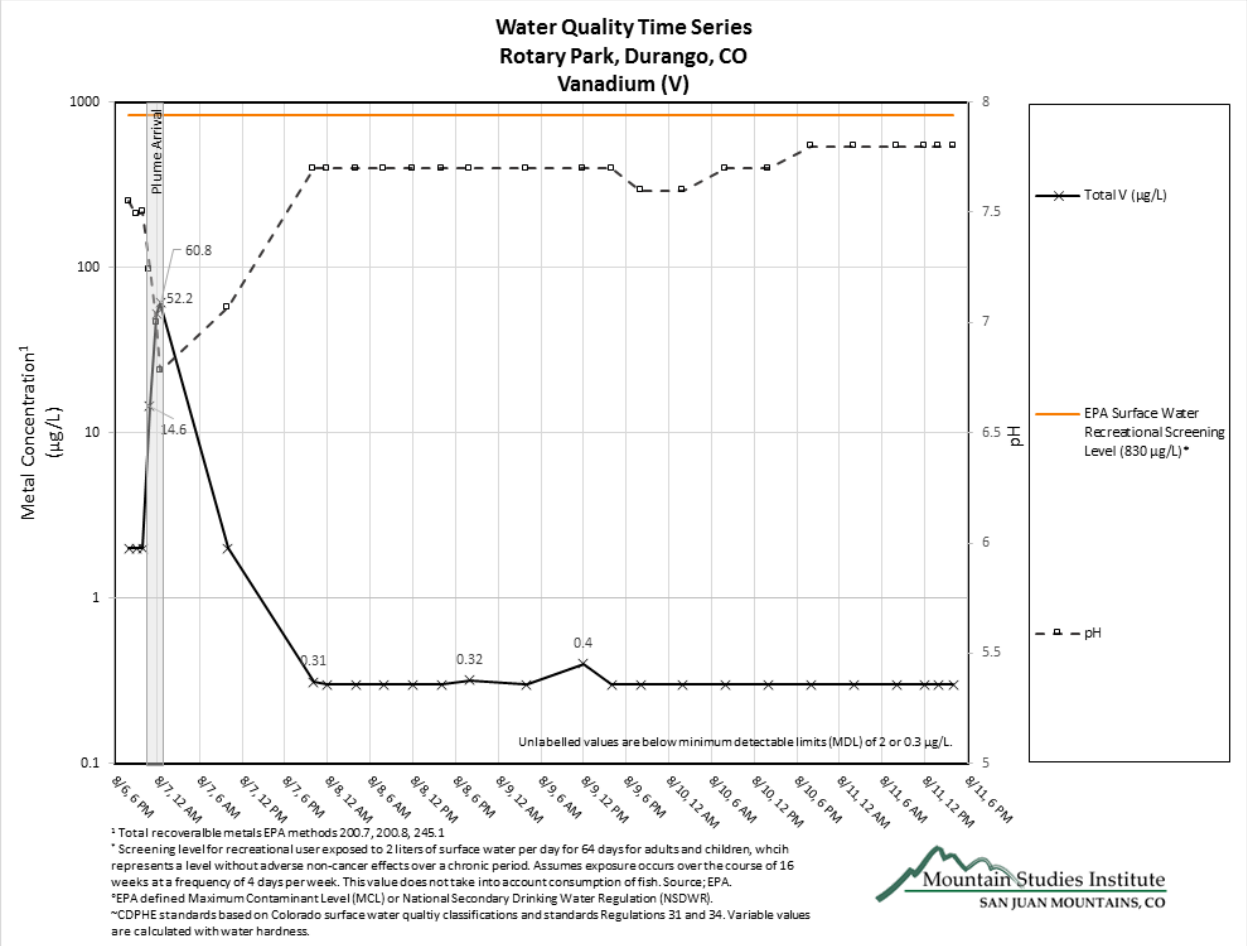

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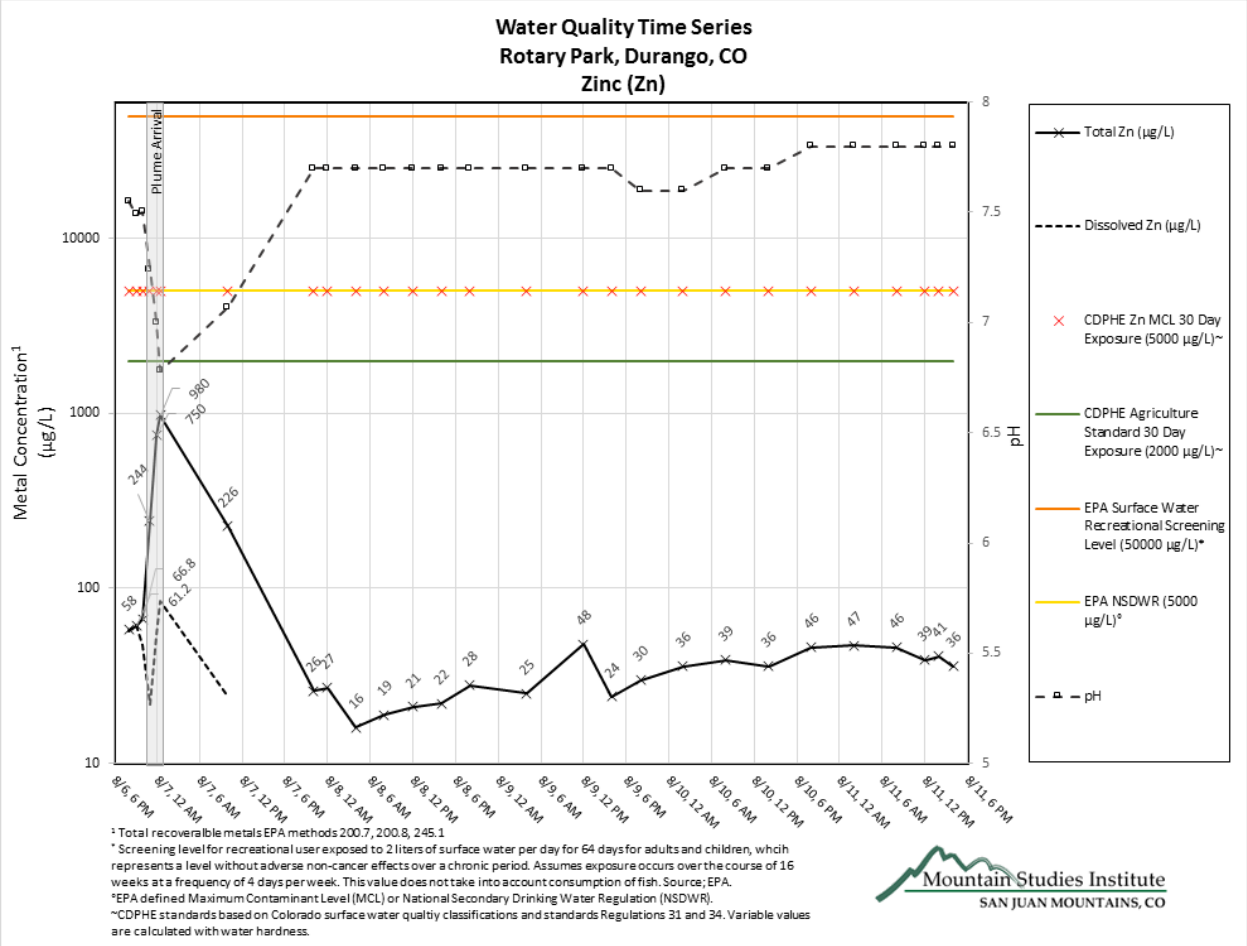

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