Water Quality Impacts of Helene

A SUMMARY OF MOUNTAINTRUE'S SAMPLING EFFORTS POST-HURRICANE HELENE

Introduction

Hurricane Helene was a massive storm that hit WNC late September 2024. It brought unprecedented rain and winds to our mountain region, and devastated lives, homes, and businesses. From mud and debris slides to washed out drinking and wastewater infrastructure, recovery from this storm will take decades. The sheer nature of its impact is startling. Asheville saw almost 14" of rain over a 3-day period. The winds that accompanied it were between 40-90mph, felling trees in all directions and causing weeks-long power outages.

On top of all the personal loss and tragedy, the water from the storm carried pollutants of all shapes and sizes into the river. Gas stations flooded, releasing diesel and petroleum. Houses and businesses got swept away, bringing in everything inside them. From propane tanks, cars, and furniture, to toys, trash, and plastics, the amount of debris is staggering. When houses and cars get swept into the river, so does everything in them - including gasoline and fertilizers, or paints.

If an industrial facility gets flooded, it's the same. For this reason, one of MountainTrue's first efforts was to get a sense of what was in the river, and if it was toxic. Understandably, people were interested in mucking out their homes and businesses as soon as possible. We wanted to give them accurate information on how safe that may be.

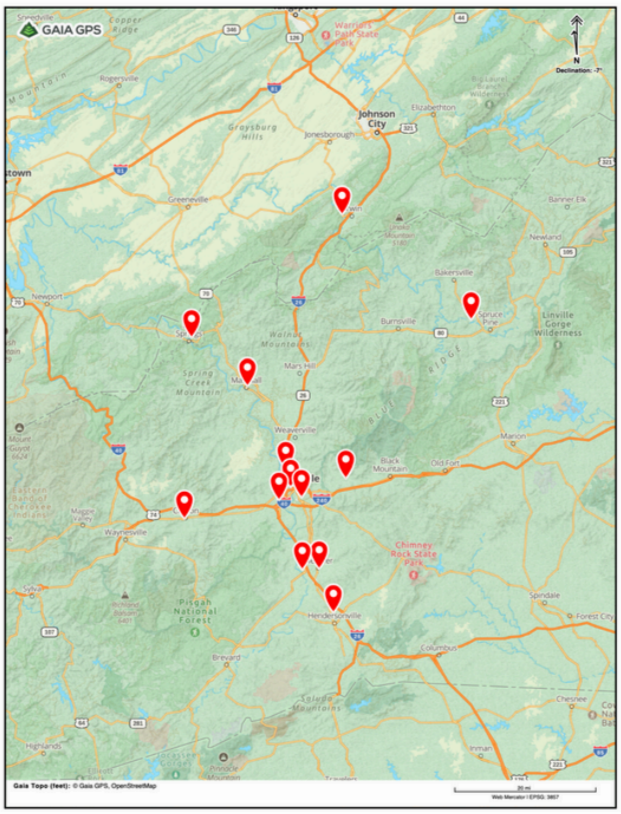
We ran several sets of samples across the majority of the watershed, looking at petroleum and diesel based products, chemicals, and heavy metals. We took both surface water and soil samples. Surface waters can flush pollutants downstream easily, but sediments tend to hold onto industrial pollutants for more significant periods of time. We chose 14 sites trying to give the broadest sense of water quality impacts across the watershed, while also trying to highlight what some particular industries' impact on the river might be. Our first set of samples was about 2 weeks after the storm, and it had not rained. The second set of samples was during our first major rain since Helene, about a month after. Our thought process was that the rains would bring into the river whatever the floodwater sediments had held onto. A final, third set was taken about six weeks after the storm. We used two different, EPA-certified labs to run the samples, as the first lab's processing time was quite delayed. All raw results will are linked here.

Background

There are a few things to keep in mind when reading the results of this report. One is that there are different standards of pollutants in the waters depending on the way that water is used. Drinking water standards are the most strict, since that water is meant for daily consumption. Within drinking water standards, there are primary standards which are for health reasons and enforceable, and secondary standards, which are for aesthetic reasons, and are basically recommendations to drinking water operators. It's important

to note that we are using these thresholds merely as a baseline of what is healthy or not. We do not recommend drinking water from any of these places, and if a sample site is clean based on drinking water standards, it will also be clean for recreation. Where formal, drinking water standards don't exist, the EPA also has human health guidelines. The elements that fall under these human health criteria can have different thresholds depending on if someone is drinking the water and eating the fish, or if they are just eating the fish. So you can see, it can be tricky to answer someone when they ask, "Is the river safe?." Our intention is to lay out the results and interpretations so that people can make informed decisions for themselves.

Map of MountainTrue Sample Sites



Drinking Water Standards

Drinking Water Standards	Primary Drinking Water	Secondary Drinking Water
Most Strict; meant for daily consumption	Health implications	Aesthetic and taste

Below you'll see EPA's drinking water standards. It is important to note these below are not all of EPA's standards, just the metals and minerals that showed up in the samples we collected after Hurricane Helene.

Parameter	Drinking Water Standard or Recommendation	Notes	Where it comes from
Aluminum	50-200 ug/L	Doesn't pose health risk; but could affect the color of water	natural element
Barium	2000 ug/L	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium	100 ug/L	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits
Copper	1300 ug/L	Short term exposure: Gastrointestinal distress; Long term exposure: Liver or kidney damage	Corrosion of household plumbing systems; erosion of natural deposits
Iron	300 ug/L	This level is based on aesthetic concerns, such as taste, color, and odor, rather than health effects	natural element
Lead	0 ug/L	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Magnesium	35,000 ug/L	contribute to water hardness, which can cause soap scum to form and scale to build up in pipes, boilers, and water heaters. Magnesium can also make drinking water taste undesirable	natural mineral
Mercury	2 ug/L	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands
Strontium	4,000 ug/L * USGS benchmark - not EPA	chronic exposure can be harmful for bone development, and for people with kidney disease	natural metal; found in tv's, phosphorescent paints, and fireworks

Human Health Guidance Criteria

Below you'll see a table of some of EPA's Secondary Human Health Criteria. These exist where no formal drinking water parameters exist. They are not enforceable by law, but are more for guidance. It is important to note these below are not all of EPA's standards, just the metals and minerals that showed up in the samples we collected after Hurricane Helene.

Parameter	EPA Human Health: Fish and Water	EPA: Fish Only	Notes	Where it comes from
Manganese	50 ug/L	100 ug/L	not based on toxic effects, but rather is intended to minimize objectionable qualities such as laundry stains and objectionable tastes in beverages.	trace element
Nickel	610 ug/L	4600 ug/L		trace element
Pyrene	20 ug/L	30 ug/L	The health effects of brief exposures to pyrene are unknown. Longer-term animal studies show that pyrene can cause nephropathy (kidney disease) and decreased kidney weight.	component of coal tar, crude oil, and fossil fuels
Zinc	7400 ug/L	26,000 ug/L	taste and odor	trace element

Other Parameters and Sediment Sampling

Another important consideration is that while we took samples of the water itself, we also sampled the sediments near the riverbanks. While pollutants within the waterway can dilute or flush downstream during a storm, sediment particles can hold onto toxins for longer periods of time. Floodwaters deposited massive amounts of sediment along all our rivers and streams. It was important to note what was in these sediments, as people began mucking homes and businesses. Additionally, sediments can easily migrate into our waterways, bringing with them any toxins they may be harboring. Some pollutants can degrade in the sun quickly, but others can take weeks or more. Most of the heavy metals and petroleum based products we saw came from our sediment samples, not from the water itself.

To determine the risk to human health when coming into contact with the sediments we used NCDEQ's guidelines for soil remediation with underground storage tanks, which is linked here. We used values based on residential soil cleanup, as those were the most restrictive and therefore, more protective of human health. Below are the most common of the elements that exceeded these guidelines that we saw in our soil samples.

Parameter	**Notes**	**Where it comes from**
Diesel Range Organics	petroleum-based compounds, from diesel fuel; NC guideline of remediation for residential soils is 10ppm; DROs are hydrophobic, bind to sediment particles, and are not readily absorbed by plants grown in the soil, but contact with DROs comes from working with or breathing in with contaminated soils and can cause health impacts. Wearing PPE in these areas is recommended.	leaking vehicles or machines
Chromium	There are 2 types of chromium - Chromium (III) and Chromium (VI). Chromium (III) is typically found in soils. It is not usually harmful to human health except in extremely high doses. Chromium (VI) is not common in soils, is much more toxic and can be a carcinogen when inhaled. Our samples looked at Total Chromium only and did not distinguish between the two types. It is our educated guess that our sediments showed Chromium (III) and not Chromium (VI), since it was only picked up in sediment samples. Out of an abundance of caution we are using the NCDEQ residential cleanup standard 1.32 mg/kg as our exceedance level in the results listed below. For reference, the average amount of Total Chromium in NC soils is 32.4 mg/kg. If you have concerns about gardening, it is recommended that you pursue further soil testing on your own property.	is natural, but can be a contaminant

Results by Site

HOT SPRINGS

10/16/24 Sediment + Water

10/24/24 Water

Water: Sample results from 10/16 showed iron at 367 ug/L, and EPA standard is 300 ug/L. This threshold is based for aesthetic reasons with exceedances leading to rusty colors or metallic tastes, and not for health implications.

Sediment: Sample results from 10/16 showed chromium to exceed NCDEQ's residential remediation recommendation. Results showed 13.9mg/kg, and DEQ's guideline is 1.32mg/kg.

MARSHALL

10/05/24 Sediment
10/16/24 Water
10/30/24 Sediment
11/14/24 Water

Water Sample results from 10/16 showed iron to to surpass EPA's secondary standards. The results for iron came were 471 ug/L, and EPA standard is 300 ug/L. This threshold is based for aesthetic reasons with exceedances leading to rusty colors or metallic tastes, and not for health implications. Our 11/14 water sample resulted in no exceedances.

Sediment We were especially concerned about Marshall due to a lot of rumor-milling about melting boots from folks working to muck flooded buildings. We took a sediment sample there as early as we could, 10/5/24. Results showed 32.6 mg/kg for chromium, which exceeds NCDEQ's guideline of 1.32 mg/kg. It also showed 0.17 mg/kg for mercury. There is no formal guideline for mercury in soil, but NC State Extension mentions New York's code for mercury is 0.81ppm (or mg/kg). It assumes mercury's most toxic form and anticipates gardening usage, so this standard is a very conservative value and based in an abundance of caution. Our sample was well below that value.

Our 10/30/24 sediment sample resulted in 16.9 mg/kg for Diesel Range Organics (DRO). While there is no federal or state regulatory standard, North Carolina recommends taking action to remediate soils that surpass 10 parts per million or 10mg/kg. It's important to note that ingestion of these elements or contact with them would remain low if folks wear proper PPE.

WOODFIN

10/30/24 Sediment

Sediment We have one sample from the French Broad in Woodfin on 10/30/24. It resulted in 37.4 mg/kg of Diesel Range Organics (DRO).While there is no federal or state regulatory standard, North Carolina recommends taking action to remediate soils that surpass 10 parts per million or 10mg/kg. It's important to note that ingestion of these elements or contact with them would remain low if folks wear proper PPE.

ASHEVILLE RAD -
French Broad River
10/16/24 Water
10/16/24 Sediment
11/14/24 Water

Water Our 10/16/24 sample resulted in 0.18 mg/L of Gas Range Organics (GRO). It also read 478 ug/L for aluminum, and the EPA recommendation is between 50-200 ug/L. This threshold is based for aesthetic reasons with exceedances leading to rusty colors or metallic tastes, and not for health implications. Iron came in at 971 ug/L. EPA guideline is for 300 ug/L. Again, this is a secondary standard based on aesthetic and taste values, not health implications. Manganese was 136 ug/L, and EPA guidelines recommend 50 ug/L. This is also based on taste and aesthetic reason. Our next water sample on 11/14/24 resulted in no contaminants of concern.
Sediment We took a sediment sample on 10/16/24. It resulted in 10.8 mg/kg in chromium, which exceeds NCDEQ's guideline of 1.32 mg/kg.

ASHEVILLE WEST -
Hominy Creek
10/16/24 Water
10/16/24 Sediment

Water Our 10/16/24 water sample resulted in 607ug/L of iron, which exceeds EPA's guideline for drinking water of 300ug/L. This is a secondary standard that relates only to taste and aesthetic values. Manganese read 109ug/L, exceeding the EPA's 50ug/L guidelines for taste and color values.
Sediment Our 10/16/24 sediment sample resulted in 17.2mg/kg of chromium, which exceed NCDEQ's guideline for soil remediation of 1.32mg/kg.

ASHEVILLE BILTMORE VILLAGE -
Swannanoa River
10/30/24 Sediment + Water
11/14/24 Water

Water We took a water sample on 10/30. It resulted in no contaminants of concern. Our 11/14 water sample also revealed no contaminants.
Sediment Our sample from 10/30 showed 74mg/kg of DRO. While there is no federal or state regulatory standard, North Carolina recommends taking action to remediate soils that surpass 10 parts per million or 10mg/kg. It's important to note that ingestion of these elements or contact with them would remain low if folks wear proper PPE.

SWANNANOA -
Swannanoa River
10/30/24 Sediment
11/14/24 Water

Water Our 11/14 water sample resulted in no elements of concern.
Sediment Our 10/30 sediment sample resulted in 69.7mg/kg DRO.While there is no federal or state regulatory standard, North Carolina recommends taking action to remediate soils that surpass 10 parts per million or 10mg/kg. It's important to note that ingestion of these elements or contact with them should remain low if folks wear proper PPE.

HENDERSON COUNTY - *French Broad River* *10/16/24 Water* *10/16/24 Sediment*	**Water** Our 10/16 water sample surpassed EPA guidance on aluminum and iron, resulting in 203ug/L and 453ug/L respectively. **Sediment** Our 10/16 water sample surpassed NCDEQ guidance for chromium, at 8.6mg/kg.
FLETCHER - *Cane Creek* *10/16/24 Sediment + Water* *11/14/24 Water*	**Water** Our 10/16 water sample showed 231ug/L for aluminum; 690ug/L for iron, and 102ug/L in manganese.These all surpass EPA's secondary guidelines for drinking waters based on taste and color. Our 11/14 sample showed no elements of concern. **Sediment** Our 10/16 sediment sample resulted in 5mg/kg for Chromium, exceeding DEQ's guidelines for soil remediation.
HENDERSONVILLE - *Mud Creek* *10/16/24 Water* *10/16/24 Sediment*	**Water** Our 10/16 water sample showed aluminum at 257ug/L and iron at 498ug/L. **Sediment** Our 10/16 sediment sample showed an exceedance in chromium at 7.0mg/kg.
CANTON - *Pigeon River* *10/15/24 Water*	**Water** No exceedances in this water sample.
CLYDE - *Pigeon River* *11/14/24 Water*	**Water** No exceedances in this water sample.
PENLAND - *North Toe* *10/16/24 Sediment + Water* *11/14/24 Water*	**Water** Our 10/16 water sample resulted in 478ug/L in aluminum, 942ug/L in iron, and 140ug/L in manganese. Our 11/14 water sample showed no exceedances. **Sediment** Our 10/16 sediment sample results showed 14.8mg/kg in chromium.

ERWIN, TN - *Nolichucky River* *10/16/24 Sediment + Water* *10/30/24 Sediment + Water*	**Water** Our 10/16 water sample resulted in 252ug/L in aluminum, 755ug/L in iron, 174 ug/L in manganese. Our 10/30 sample showed no exceedances in the water. **Sediment** It is important to note that the two samples were taken at different sites. the 10/16 sample was taken above the town of Erwin, and thus upstream of plastics manufacturers. The 11/14 sample was taken below the town, and and downstream of several plastics manufacturers. Our 10/16 sediment sample only showed exceedances in chromium at 15.1mg/kg. The 10/30 sediment sample showed 45.7mg/kg in DRO.

Conclusions and Future Implications

Generally speaking, what we found in both surface waters and sediments wasn't worrisome. The metals or elements each sample picked up were either benign or in such low concentrations to be deemed insignificant. We continue to tell people to wear PPE to keep themselves safe when mucking homes or businesses or when doing cleanups, as there are several wastewater treatment plants that are either still offline or in repair. The storm has highlighted a real need to think deeply as we rebuild. Where and how we rebuild will be a crucial element to our resiliency in the face of these more intense storms.

Contact

MountainTrue is continuing to monitor and clean up our waterways from Hurricane Helene. Feel free to reach out to us at mountaintrue.org.

MountainTrue
Protecting the places we share
29 N. Market St. #610, Asheville NC 28801
(828) 298-8737
Website: mountaintrue.org

Resources:

USGS: Health-Based Screening Levels for Evaluating Water-Quality Data: https://water.usgs.gov/water-resources/hbsl/index.html

EPA: primary drinking water standards: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

EPA: secondary drinking water standards: https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals

EPA: human health criteria: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

NCDEQ: Soil Remediation Guidelines: https://www.deq.nc.gov/ustcab-tableschange-52022/open

DRO: https://sites.nicholas.duke.edu/superfund/files/2018/08/DRO_Factsheet-DukeSuperfund.pdf

Mercury: Mercury in the Garden: https://gardening.ces.ncsu.edu/soils/soil-contaminants/mercury-in-the-garden/#:~:text=Making%20sense%20of%20regulatory%20standards,represents%20an%20abundance%20of%20caution.

Chromium: Chromium in the Garden: https://gardening.ces.ncsu.edu/soils/soil-contaminants/chromium-in-the-garden/#:~:text=Making%20Sense%20of%20Regulatory%20Standards&text=For%20remediating%20soil%20at%20industrial,levels%20in%20your%20garden%20soil.