

Project Hydration: A Clean Drinking Water Solution for Washington, D.C.

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Abstract

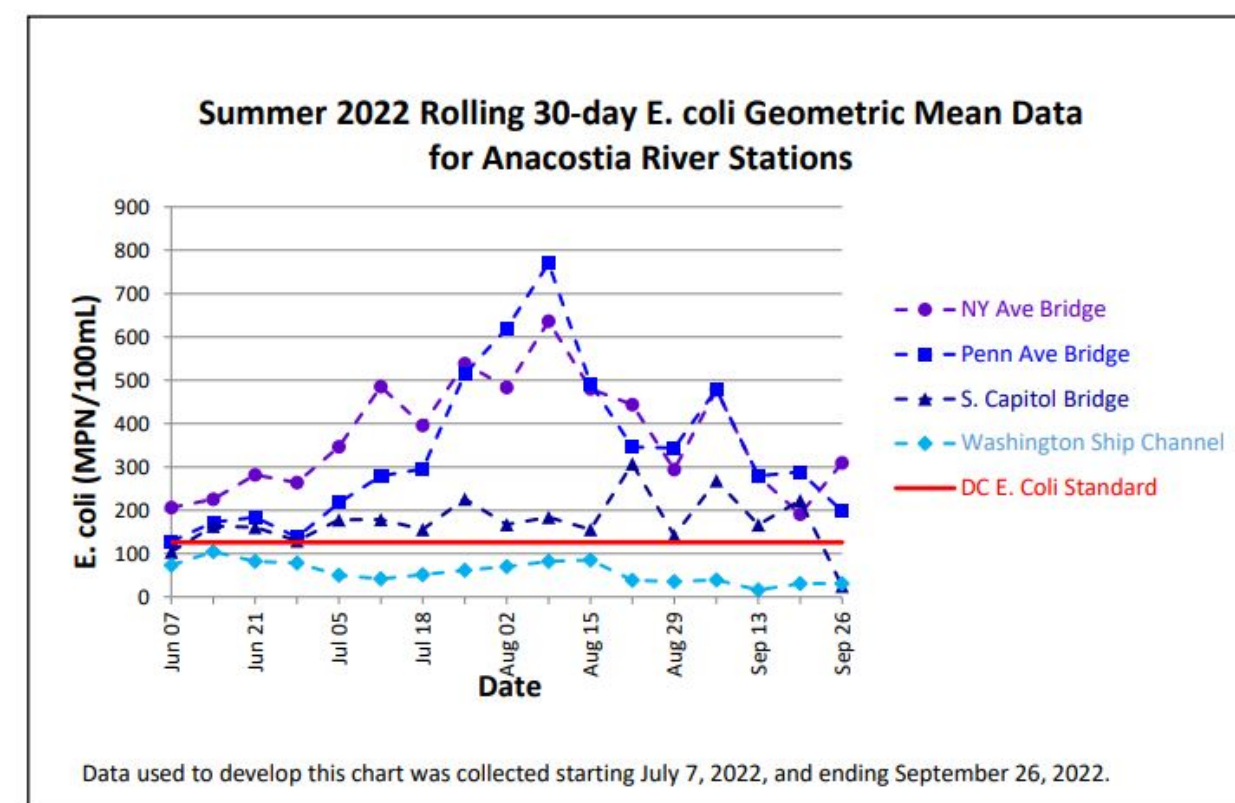
Water pollution is a global issue that has been ongoing since 1800 (NOAA,2024). Water pollution occurs when harmful substances, mostly chemicals or microorganisms, contaminate a stream, river, lake, ocean, aquifer, or other body of water, creating harmful water quality and rendering it toxic to humans and the environment. D.C. has faced ongoing challenges with lead contamination in its drinking water. As of 2024, D.C. Water still has tens of thousands of lead service lines (D.C. Water, 2024). Lead is a poisonous metal in small amounts in the earth's crust. On May 8, 2024, D.C. issued a boil water advisory due to water pollution, stating that the water was of "unknown quality," (D.C. Water, 2024). Another boil water advisory was lifted on July 4 as people continued to boil their water out of fear of contamination. Project Hydration will combat this with a "hydration" filtration kit that would detox the water of all harmful chemicals, like lead and E-Coli. This six-month program will initially target one hundred Ward 7 residents. Project Hydration would give D.C. residents peace of mind and the ability to have safe water to drink and bathe in.

Epidemiology

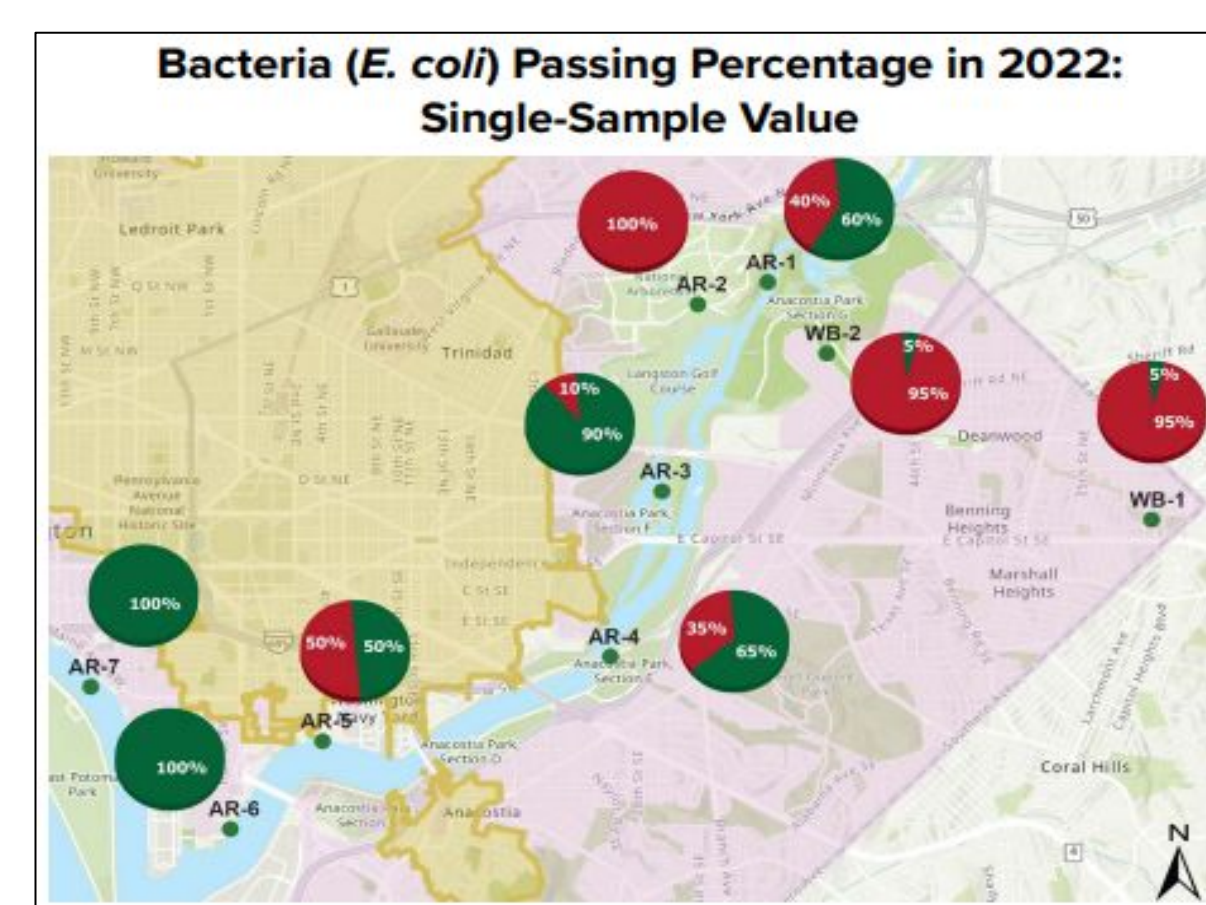
After speaking with local D.C. residents, data shows that some believe the water is unsafe and unsanitary. Residents had to take extra steps to ensure they had safe water. For example, interviewed resident Chad Williams stated, "The toilet pipes are connected [to] the kitchen and the bathroom pipes and I did not trust the water, so I decided to boil it to get any germs or particles out to make it safe to drink." Like most D.C. drinking water, Williams' drinking water comes from the Potomac River (DC Water, 2024). The Potomac and Anacostia Rivers frequently experience water pollution from different pollution permit holders in D.C., such as PEPCO, Washington Navy Yard, and Bardon, INC (Calma, 2020). Because of this, "District waters only passed E. Coli tests at 54%, meaning 46% of District waters are at risk of containing E. Coli...53% for the Anacostia River, 72% for the Potomac, and 37% for Rock Creek" (D.C. Policy Center, 2024). Additionally, In 2010, the C.D.C. released a report stating that lead was found in tap pipes (C.D.C., 2010). Following the report, many D.C. residents found government funding or paid out of pocket to replace their lead pipes.

Facility Name	Issuance Date	Year of Expiration
Barton Inc. (BIA) Aqueduct Intake, via Super Connector	POTOMAC RIVER/ANACOSTIA RIVER	2024
D.C. Metropolitan Sewer System (MSSW)	POTOMAC RIVER/ANACOSTIA RIVER	2024
D.C. Water and Sewer Authority (DCA) Treatment Plant at Bar Park, Bar Park	POTOMAC RIVER	2024
Genova Services Administration (GSA) West Hocking Plant	POTOMAC RIVER	2024
ATC Center for the Potomac River	POTOMAC RIVER	2024
Clash Memorial Wastewater Plant	ANACOSTIA RIVER	2024
National Research Institute	ANACOSTIA RIVER	2024
Potomac Electric Power Company (PEPCO) Spring Generating Station	ANACOSTIA RIVER	2024
Washington Aqueduct Water Treatment Plant	CHESAPEAKE BAY	2024
Washington Navy Yard	TOTAL BASIN POTOMAC RIVER	2024
WASA Wastewater Pumping Station	TOTAL BASIN POTOMAC RIVER	2024

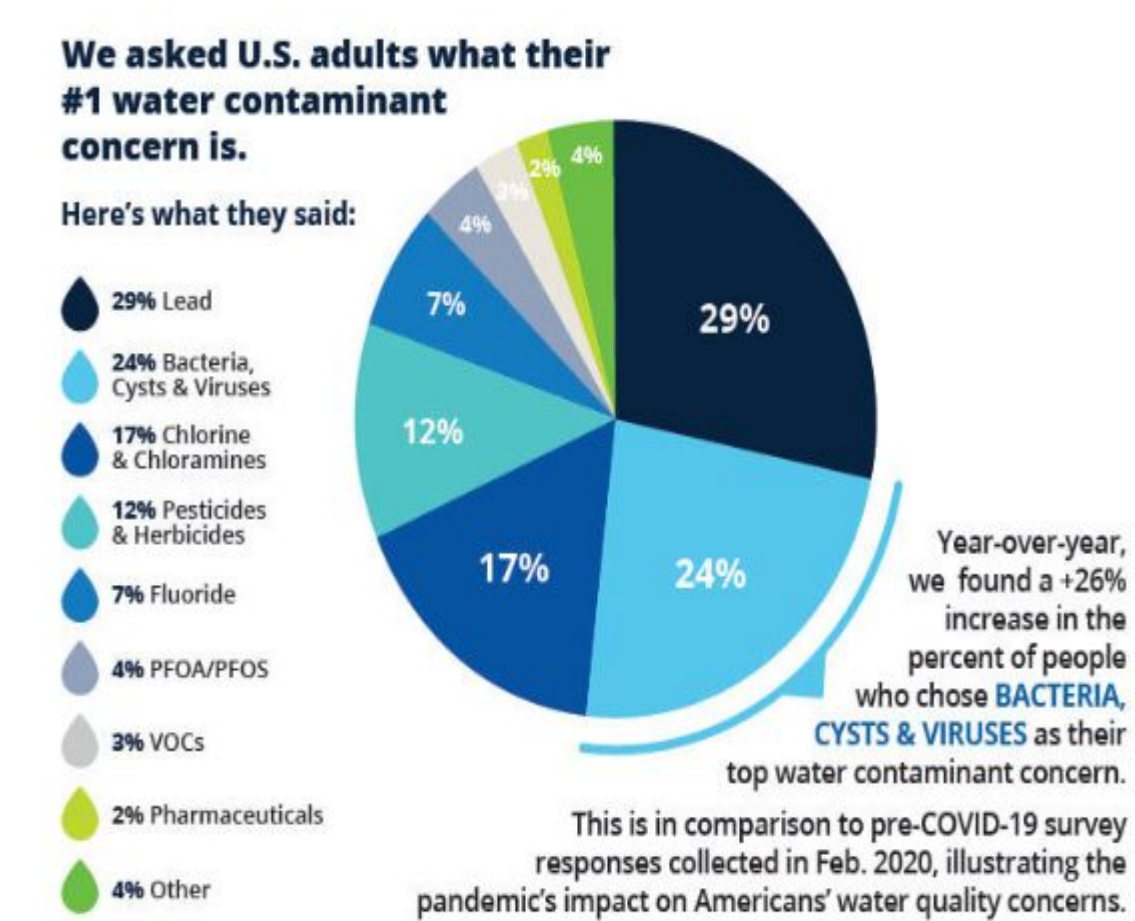
(Calma, 2020)



(Doe DC, 2022)



(Doe DC, 2022)



(Carollo, 2020)

Program Implementation

Project Hydration will tackle the significant health issues caused by contaminants like E. Coli and lead in the water supply. First, we will focus on Ward Seven because its water source recorded significantly high pollution levels. In ward seven, there are high levels of E-Coli (Doe DC, 2022). Each kit will include multilingual instructions, a portable turbidity meter that detects particles in water, and advanced testing strips (litmus paper that turns a pinkish-red color when contaminated water is absorbed) to detect E. coli bacteria and contamination. Residents can use the UV sterilization filtered water pitcher to purify their water if contamination is detected: the filtered water pitcher uses Affinity filtration technology to remove lead from water; the UV sterilization device uses ultraviolet light to kill microorganisms. We will provide a phone number for residents to report issues and help identify and address problems or difficulties with the kit. Instructions on the kits will be available in the six most spoken languages in DC. Additionally, the hydration kits will have visual aids to help individuals better understand how to use the kit; if the person has trouble reading, visual aids can also assist them.

Program Evaluation

To ensure the hydration kits are working, we will provide a hotline number on the kit's box, where the residents can call or text to let a neutral party know if additional kits are needed. A survey, linked via the QR code on the box, will be used to let us know the results of the turbidity meter and limitus paper. We will send out the survey every month for six months to see the progress of the filtration kits. Using the data collected from the monthly surveys, we will construct a graph to ensure that water quality is improving.

Logistics/Timeline

The Hydration program will begin with an initial phase. This phase will last six months, and we will distribute kits to a randomly selected sample of one hundred people in Ward seven, during which a team of dedicated volunteers will distribute the kits door-to-door. We will closely monitor water quality levels across ward seven by gathering statistics through monthly surveys. If data shows that water quality is improving, the distribution of the kits will then expand across D.C. Kits will be available in public institutions such as schools or libraries. Feedback will be collected during this period via surveys to refine the kits accordingly.

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Theoretical Grounding

The detriments of drinking unclean water are extensive and far-reaching. The DC Policy Center classified bodies of water in the city as "impaired" for marine and human life because of high E. Coli levels, high pH, low oxygen, and high turbidity levels in the water (Calma, 2020).

Lead, detected extensively in DC drinking water, can increase the risk of miscarriage in pregnant women (NIH, 2023). If the mother's lead level is too high, she may be forced to stop breastfeeding, or else the child will be put at risk (CDC, 2024). Lead is a neurotoxin (a poison that acts on the nervous system). Lead can damage the brain, injure tissues and organs, slow blood formation, and kill (DCWater, 2024). Brain damage caused by lead results in IQ loss, hyperactivity, concentration/behavior problems, and more (DCWater, 2024). When lead contaminates sperm, its shape, size, number, and mobility change, negatively impacting fertility (NIH, 2022). When children drink unclean water, they are at greater risk of developing gastrointestinal illnesses, learning disorders, endocrine disruptors (stunted growth), and cancer (NIH, 2022). AFFINITY® filtration technology, used inside the provided water pitcher, uses six advanced barriers to catch lead and 99% of most contaminants. (Clearly Filtered, 2021) The DC water system has also continuously been at risk for E. Coli Exposure. Drinking water with E. Coli has been shown to lead to high fever, bloody diarrhea, meningitis, septicemia, urinary tract, and intestinal infections (Water Science School, 2018). With E. Coli strain 0157:H7, small children and the elderly are also at risk of death (Water Science School, 2018).

Conclusion

With correct implementation, lead concentration in the homes of DC residents should significantly decrease. The half-life of lead in human blood is about one month, so residents struggling with mild lead poisoning should have the condition cleared up around a month after receiving treatment (CDC, 2023). According to CDC.gov, 98.7% of E-Coli in drinking water can decrease by 49.7% if treated by filtration. With the water testing kits, any residents unaware of lead and E. coli in their water will be informed and can go to the hospital for treatment.

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